

**Improving Anesthesia Provider Compliance with a Postoperative Nausea and Vomiting
Prophylaxis Protocol**

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Abstract

Problem: At a community hospital, an estimated 33% of ambulatory surgery adult patients experience postoperative nausea and vomiting (PONV). The hospital's chief nurse anesthetist reports 25% compliance among nurse anesthetists with the existing PONV prophylaxis protocol.

Purpose: The purpose of this quality improvement project is to increase the compliance of nurse anesthetists with the PONV prophylaxis protocol for adult patients undergoing elective procedures with general anesthesia. **Methods:** Implementation strategies for the practice change include the placement of a large poster of the protocol in the anesthesia lounge and in each operating room and conducting a formal information session on the protocol. Additionally, the Project Lead performed weekly audits of the facility's "PONV Dashboard," wherein the compliance score of each anesthesia provider is tracked, and informed the nurse anesthetists of their weekly compliance and ongoing performance with the protocol. **Results:** In the first week, there was an average compliance score of 43% with the protocol. In subsequent weeks, the average compliance increased to 58% then 83%. However, there was a decrease in compliance scores from weeks 4 through 9. Of note, a change in the frequency of the PONV Dashboard being updated caused lags in nurse anesthetists receiving feedback on their compliance. After week 9, the compliance scores were updated from the previous month and compliance began to improve until the next time scores were made available. **Conclusions:** The findings point to the display of a protocol in highly visible spaces and routinely informing providers of how well they comply with the protocol as methods to increase protocol compliance. By keeping providers engaged with their performance, they are more likely to adhere to a PONV protocol, with the implication of a reduction in the occurrence of PONV for patients following general anesthesia.

Keywords: PONV, postoperative nausea and vomiting, CRNA, nurse anesthesia

Improving Anesthesia Provider Compliance with a PONV Prophylaxis Protocol

The experience of postoperative nausea and vomiting (PONV) is common among postsurgical patients. The complications of PONV, which include dehydration, pulmonary aspiration, wound dehiscence, prolonged recovery stays, and unanticipated hospitalizations, point to the importance of mitigating this problem (Elsaid et al., 2021). The impact of these complications include increased morbidity, increased cost (it costs \$90 dollars more for recovery for patients experiencing PONV than those who do not), and decreased patient satisfaction, which can negatively affect the relationship between patients and providers and between the community and the hospital, as well as insurance reimbursement for healthcare services (Gress et al., 2020).

According to the chief nurse anesthetist at a local community hospital in the Baltimore-Washington corridor, an estimated one-third of postoperative ambulatory adult patients experience PONV (S. Reynolds, personal communication, November 10, 2022). Furthermore, the chief nurse anesthetist reports that while a standardized, evidence-based protocol for PONV prophylaxis exists for anesthesia providers (see Figure 3), there is only a 25% compliance rate with the protocol among certified registered nurse anesthetists (CRNAs) at this facility.

Within the last year, a high turnover rate has left the anesthesia department at this facility with only two full-time providers and a staff that is supplemented by temporary CRNAs. Over the same period, the reports of PONV among patients varied widely from one provider to the other and the incidence of PONV increased overall (S. Reynolds, personal communication, November 10, 2022). The large influx of transient providers, who may be unfamiliar with the protocol, is a major contributor to the problem of PONV. This is evidenced by the low compliance rate of CRNAs with the protocol and the upward trend of PONV reported. These

occurrences pointed to the need for a practice change to improve CRNA compliance with the PONV prophylaxis protocol, which entailed completing a risk stratification for all adult patients undergoing general anesthesia and administering antiemetics based on the number of patient risk factors.

Available Knowledge

Based on a review of the evidence, achieving a reduction in the incidence of PONV occurred when patients received antiemetics based on individualized risk stratification (Ma et al., 2022). At this local hospital, an evidence-based protocol already existed. Therefore, the adherence of CRNAs to the protocol needed to improve. The use of formal presentations, visual prompts and reminders, and providing CRNAs with individual feedback on their adherence rate and overall performance in decreasing PONV increased their compliance rate with the protocol (Devarakona et al., 2022; Green et al., 2015; Pym & Ben-Menachem, 2018; Wood et al., 2015).

The article by Ma et al. (2022) provided the highest level of evidence, level I-A, and was the publication against which all other articles are compared. The findings of this article were consistent with those of the other articles which showed a significant decrease in the incidence of PONV when anesthesia providers prescribed and administered antiemetics based on patients' individualized risk stratification. While the remaining articles were of lower quality ratings, with the majority of them being level III-B non-experimental or quasi-experimental studies, the conclusions from these articles were consistent among each other and the results from each of the articles were statistically significant.

Devarakonda et al. (2022) and Pym & Ben-Menachem (2018) found a lower incidence of PONV occurred when providers selected and administered antiemetics based on patient risk factors. Williams et al. (2021) determined the more extensive the risk stratification, the more

prophylactic treatment that could be administered and the lower the incidence of PONV. Both Greene et al. (2015) and Pym & Ben-Menachem (2018) discussed the significance of auditing provider compliance and determined giving providers individualized feedback on their performance and patient outcomes increased anesthesia providers' adherence to standardized PONV prophylaxis protocols. Lastly, both Devarakonda et al. (2022) and Pym & Ben-Menachem (2018) also found increased dissemination of an institution's PONV prophylaxis protocol via continuing education and displaying of the protocol increased provider adherence to the protocol.

Lastly, the findings of Wood et al. (2015) paralleled those of Devarakonda et al. (2022), Pym & Ben-Menachem (2018), and Williams et al. (2021). While this was a lower level publication with a focus on provider adherence to a chemotherapy-induced nausea and vomiting protocol, Wood et al. (2015) determined provider compliance with a nausea and vomiting prophylaxis protocol increased with continued reinforcement of the protocol, whether through ongoing educational sessions or displaying posters of the protocol, and with giving providers feedback on their performance on PONV treatment. The overall quality rating of the body of evidence was a level III-B. The recommendation based on the evidence synthesis is good and consistent, pointing to a practice change.

Rationale

The PARiHS framework (see Figure 2) provides a way to implement research into practice based on the interaction between evidence, context, and facilitation (Kitson et al., 1998). The evidence in this project was a combination of the CRNAs' compliance with the PONV protocol, which was tracked by the hospital, and the evidence from research articles. The context into which the evidence was placed was an anesthesia department experiencing ongoing movement in its staffing, possessed an atmosphere that cultivated learning and ongoing

evaluation, had consistent and accountable leadership, and had existing infrastructure that supported the use of the evidence-based PONV protocol. This endeavor was facilitated by collaboration with the permanent staff and student registered nurse anesthetists (SRNAs) to be champions of the initiative, dissemination of information that was already available, the incidence rate of PONV among postoperative adult patients, the compliance score of each provider with the protocol, and regular staff meetings and recorded presentations that captured as many providers as possible.

Methods

Context

The interventions were introduced in a community hospital's anesthesia department that was staffed by full-time and temporary or agency-provided CRNAs. There had been ongoing shifts in the staffing of the department and occasional shortages that created, at times, a stressful and high-pressured work climate. A few weeks before the project's implementation, the head of the department had changed from one anesthesiologist to another and the chief CRNA no longer worked in the same capacity as she had when the project was first proposed. However, the most consistent staff were two full-time CRNAs who had worked at the facility for over 10 years each. In addition, several student registered nurse anesthetists (SRNAs) from the same school trained at this facility and included current evidence and research, such as a risk-driven protocol, in their clinical practice. This combination of personnel produced a departmental culture that was open to quality improvement and student learning experiences but a setting that had critical changes in leadership.

The resources available at this hospital included an approved, evidence-based PONV prophylaxis protocol, access to the antiemetics listed on the protocol, an existing tool to track the

compliance with the protocol and to track patient reports of PONV (called the PONV Dashboard), and allocated times for bimonthly staff meetings. Aside from the existing PONV prophylaxis protocol, there was no consistent structure or process used for risk stratification of patients and antiemetic selection. Unless a patient specifically endorsed a history of PONV, this assessment finding was not routinely included in the pre-anesthesia evaluation. Furthermore, there were observed inconsistencies among providers in the administration of antiemetic agents based on risk stratification and the order in which the antiemetics were given, contrary to what the protocol recommended.

Interventions and Tactics

Provider adherence to the PONV protocol was achieved by using an evidence-based institutional protocol, presentations on the protocol, prominent displays of the printed protocol in the operating rooms, and individual provider feedback on their compliance with the protocol when possible. The new department head was recruited as a project champion to support and enforce the process change. Furthermore, SRNAs were encouraged to collaborate with their preceptors in patient risk stratification and antiemetic selection, prescription, and administration. These process changes utilized tactics such as collaboration and communication to implement change and achieve the project goals.

The protocol was displayed in the anesthesia staff lounge and affixed to the computers used by the anesthesia providers in the operating rooms with the permission of the site sponsor. Weekly trends of patient PONV occurrences were also displayed in the staff lounge next to a large poster-sized printout of the protocol. A formal presentation on the initiative was given at the first staff meeting of the implementation phase. The project champion and the project lead facilitated dissemination of wallet-sized protocol printouts following this staff meeting. Provider

compliance scores were de-identified and posted in the anesthesia lounge next to the PONV prophylaxis poster. In addition, individual provider compliance scores were emailed to each anesthesia provider as soon as they were made available on the PONV Dashboard, along with an email attachment of the PONV prophylaxis protocol, which was facilitated by the CSR. These tactics target structures to achieve accountability, buy-in, communication, data, and education.

Measurement

Study data was collected and managed using REDCap (Research Electronic Data Capture) tools hosted at the University of Maryland. REDCap is a web-based software platform designed to support data capture for research studies. It provides an interface for validated data capture, audit trails for tracking data manipulation, automated export procedures, and procedures for data integration and interoperability.

The measurement for the process goal was conducted via two surveys among the facility's anesthesia providers wherein they reported their knowledge of the PONV prophylaxis protocol prior to implementation and their knowledge of the PONV prophylaxis protocol and implementation of patient risk stratification at the end of the implementation phase. The purpose of this measure was to determine provider awareness regarding the protocol and the impact of the information session on their clinical practice for PONV risk stratification. This measure was reliable and valid as long as what the provider documented was consistent with what the provider actually did. The hospital's quality measure tracking system for PONV is based on the type of antiemetic the provider documented administering to the patient and the patient's number of documented risk factors. The measurements were obtained using a REDCap Provider Knowledge of PONV Protocol Staff Survey and a REDCap Staff Post-Implementation Survey.

The outcome goal was measured by the facility and was based on their quality measure tracking system, the PONV Dashboard, from which provider compliance scores were obtained. It was collected in the REDCap Provider Weekly Compliance Score tool. The use of the facility's PONV Dashboard allowed for continuity of data tracking and decreased confusion in following this particular metric. Provider compliance scores were obtained by the project lead whenever it was made available on the PONV Dashboard and provider anonymity was maintained by codifying provider names with a number that was emailed to each provider separately by the CSR.

Ethical Considerations

The procedure for ethics review began with assuring a student affiliate agreement between the site and the University of Maryland was present. The DNP student submitted an application to the University of Maryland Human Research Protections Organization (HRPO) to ensure the quality improvement project did not include research components on human subjects. The project was conducted under a Non-human Subject's Research determination from the HRPO of the UMSOM Institutional Review Board (IRB). Once IRB approval was obtained, the student proceed with implementation. Participant privacy was protected by electronically recording REDCap tools inside a private, locked anesthesia workroom at the facility. The provider name in the Weekly Provider Compliance Score Tool was coded as an identifier and de-identified if downloading is necessary.

Results

A run chart was used to interpret the compliance score of the anesthesia providers (Appendix A). The protocol compliance scores of the providers were averaged based on the scores obtained for each provider from the PONV Dashboard. The average compliance score for

the first week of implementation, when the information session was conducted, was 63%. The scores for weeks 2 through 4 were 43%, 58%, 83%, respectively, representing an upward trend in provider compliance with the PONV protocol. However, from weeks 5 through 14, compliance scores seemed to plateau then trend downwards, with average compliance scores of 58%, 67%, 62%, 49%, 30%, 67%, 48%, 54%, 63%, and 57% respectively. The median compliance score throughout the implementation phase was 58%. There are no consistent trends based on the run chart as fewer than six data points laid above or below the median. The only astronomical points were observed during weeks 4 and 9, which was an average compliance score of 83% and 30%, respectively.

As mentioned, provider compliance scores with the PONV prophylaxis protocol were measured based on reports obtained on the facility's PONV Dashboard. During the planning phase of the project, the PONV Dashboard was managed by personnel who created weekly reports. Within a few weeks of the project implementation, there was a change in the personnel and in how often reports were generated and made available on the PONV Dashboard. Provider compliance was made available only once a month. This change, which occurred after week 4, led to a lag in the project lead reporting individual compliance scores back to the anesthesia providers. It is possible the time between a provider's actual performance and the reporting of the assessment of his or her performance to cause decreased interest and buy-in for the project initiative, which may explain the decline in overall compliance scores. In addition, during the implementation of the project, new anesthesia providers began working at the facility. It is possible that these new providers may not have the same level buy-in or awareness of the PONV prophylaxis protocol as those providers who attended the information session.

A bar graph was used to interpret the process data findings based on provider response to the REDCap Provider Knowledge of PONV Protocol Staff Survey (Appendix B). This information was collected during the first week of implementation, prior to the information session. Based on the survey results, most of the respondents, 60%, were aware of the PONV Prophylaxis Protocol (see Appendix A). Project facilitators included the existing PONV prophylaxis protocol and buy-in from departmental leadership. Unfortunately, barriers to project implementation and success included inconsistencies in the timeframe for giving anesthesia providers feedback on their compliance scores and some providers' resistance to practice change.

Discussion

The outcome goal for 100% provider compliance with the PONV prophylaxis protocol is not achieved. As previously mentioned, the results showed an initial increase in compliance during the first 4 weeks of the project. A sudden change in how frequently the PONV Dashboard was updated, which caused a change in how frequently providers received their compliance score, correlated with a downward trend in compliance scores. Once compliance scores were made available every four weeks, subsequent improvement was noted (see Appendix B). This indicates the value in providing timely feedback to CRNAs to promote adherence with a protocol, which aligns with the findings of the evidence. Also worth noting, there is no correlation between provider compliance scores and the frequency of PONV among adult same-day surgical patients in the recovery area (see Appendix C), despite the literature suggesting otherwise. This finding may suggest confounding factors in patients experiencing PONV at this facility or imprecisions in the project design or in the measurement tool provided by the PONV Dashboard. Nonetheless, when considering the project impact on the people and systems involved, the average compliance score of nurse anesthetists at this community hospital ranges

from 30% to 83% (versus a 25% baseline score) during the implementation phase and the average incidence of PONV among adult same-day surgical patients during the implementation phase is 8.2% (versus a 33% baseline incidence). Therefore, the quality improvement project yields an improvement in CRNA compliance with the PONV prophylaxis protocol as well as an improvement in patient outcomes, overall. Within the framework of the PARiHS Model, the interaction between the evidence presented during the pre-implementation education session, the context of the anesthesia department in which the quality improvement project was carried out, and the facilitation provided by staff and student collaboration and the use of pre-existing resources allowed for the successful implementation of research into practice (Kitson et al., 1998).

Furthermore, when considering a financial analysis of the quality improvement project, the cost of this project is limited to the printing cost for the actual PONV protocol and for the de-identified printout of each providers' compliance score. Otherwise, the antiemetics in the protocol are formulary, the PONV Dashboard is already in use by the hospital, and communication with the providers requires the time of the project lead. According to Bruno et al. (2019), the cost of postoperative recovery for patients experiencing PONV was about 12% more than for those who did not experience PONV (\$730 versus \$640). What's more, Gan et al. (2020), patients are willing to pay an average of \$56 for an antiemetic that completely eliminates PONV. Needless to say, the return on investment for this quality improvement project is invaluable.

Plans for sustainability and potential spread include the incorporation of a recorded presentation in the onboarding process for new hires, giving each provider access to the PONV Dashboard so they can monitor their progress individually, and giving monthly reminders of the

initiative at anesthesia staff meetings. Moreover, since the protocol is used by all anesthesia providers within the hospital's healthcare system, communication between anesthesia department heads of each hospital can include additional strategies that are effective in improving compliance at all facilities.

Conclusion

This project utilizes feasible and hospital-tailored implementation tactics to improve anesthesia provider compliance with an evidence-based PONV prophylaxis protocol to improve patient outcomes and patient satisfaction. The methods utilized are safe, cost-effective, easily sustainable, and can be spread to other facilities in the healthcare system.

As mentioned, one of the greatest strengths of this project is the invaluable return on investment. When compared to the increased cost of treating PONV and the additional costs patients are willing to incur to avoid experiencing PONV, expenditures on printouts are seemingly nominal in light of the benefit improving provider compliance facilitates.

Furthermore, the other aspects of the project, such as the use of the PONV Dashboard to track provider compliance scores and patients' incidence rates of PONV, the evidence-based PONV prophylaxis protocol, and the antiemetics utilized within the protocol, are available to the other hospitals within the healthcare system, which gives a promising avenue for the sustainability and spread of the project. On the other hand, these very elements may be the greatest limitation to the inability of the project to be applied in facilities outside of the hospital's healthcare system.

Implications for practice based on this project is the utilization of various, context-specific strategies to improve anesthesia providers' compliance with a facility's protocol. Recommendations for future quality improvement initiatives may include reporting provider compliance scores more frequently than every four weeks, reporting the incidence of PONV

among the patients for which each nurse anesthetist provided care, and communicating with individual providers who struggle with adhering to the protocol to improve compliance with the PONV prophylaxis protocol. Other recommendations include the use of a PONV prophylaxis protocol that utilizes other antiemetics and comparing the incidence of PONV among patients using the different protocols to determine if one protocol is more effective than another in reducing PONV. Finally, this quality improvement project can be used to determine if compliance with other protocols is attainable using the same implementation strategies.

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Table 1*Evidence Review Table*

Citation: Ma, W., Qi, Y., Liu, C., Wang, M., Zhang, Y., & Yao, W. (2022). Effect of individualized treatment strategy on postoperative nausea and vomiting in gynaecological laparoscopic surgery: A double-blind, randomized, controlled trial. <i>BMC Anesthesiology</i> , 22(1). https://link.springer.com/article/10.1186/s12871-022-01809-z	Level and Quality: I-A
Purpose or Hypothesis	The authors hypothesize that individualizing a treatment strategy for nausea and vomiting based on preoperative risk factors can prevent PONV in gynecological laparoscopic patients.
Type of Evidence Research Design	Double-blind, randomized, controlled trial
Sample Population, Size, Setting	Convenience sampling Population: 120 patients aged 18-65 undergoing laparoscopic gynecological surgery under general anesthesia that is expected to last at least 1 hour, classified as ASA 1 or 2 Exclusion criteria: patients with known gastrointestinal disease, patients allergic to drugs, patients having taken an antiemetic within 24 hours before surgery Setting: First Affiliated Hospital of Wannan Medical College, China Power analysis: 102 patients in each group would be needed to meet a power analysis of 90%, $\alpha < 0.05$ Group homogeneity: no significant difference in age, BMI, PONV history, motion sickness history, smoking status, post-op opioid use
Intervention Procedures	Control: patients receiving 1 antiemetic drug Intervention protocol: Antiemetics administered to patients based on the number of Apfel risk factors for PONV the patient had before surgery. Patients with 1 risk factor received dexamethasone, with 2 risk factors received dexamethasone plus ondansetron or granisetron IV, with > 3 risk factors received the aforementioned plus scopolamine. Treatment fidelity: Upheld by having operations performed by same team of surgeons, same researcher who was not involved in clinical care of patients prepared all of the drugs for administration in the study, and the anesthesia provider and surgeon were blinded to what the patient received in the OR and patients were blinded to the treatment assigned.
Primary Outcome and Measures	Dependent variable: episodes of emesis, nausea, and rescue medication during the first 24 hours post-operatively were recorded Secondary outcomes: severity of PONV, incidence of PONV, and adverse events DV measures: severity of nausea was evaluated on a PONV grading standard and efficacy of individualized treatment based on risk factors was defined as no episodes of emesis or use of rescue medication within 24 hours postoperatively; adverse events included delayed recovery (not being awake 90 minutes after anesthesia), arrhythmia (QTc prolongation), and hyperglycemia (> 6.0 mmol/L)
Results/Conclusions	Results: In the individualized treatment group, 56.7% of patients reported no PONV compared with 23.7% in the control group, which was statistically significant ($p < 0.001$). For patients with 2 risk factors, the report of no PONV was 90.9% for those who received individualized treatment per risk stratification compared with those who did not ($p < 0.05$). Severity of PONV and incidence of emesis was higher in control group than individualized treatment group. No difference noted in adverse events between both groups. Conclusion: The severity and frequency of PONV in patients receiving individualized treatment based on Apfel risk factors were significantly reduced in patients undergoing a laparoscopic gynecologic operation under general anesthesia compared with the patients in the control group.
Citation: Dewinter, G., Staelens, W., Veef, E., Teunkens, A., Van de Velde, M., & Rex, S. (2017). Simplified algorithm for the prevention of	Level and Quality: III-B

postoperative nausea and vomiting: A before-and-after study. <i>British Journal of Anaesthesia</i> , 120(1), 156–163. https://pubmed.ncbi.nlm.nih.gov/29397124/	
Purpose or Hypothesis	The authors hypothesize a simplified guideline for PONV prophylaxis would result in a lower incidence of PONV that is driven by greater compliance with the PONV prevention algorithm.
Type of Evidence Research Design	Quasi-experimental study design
Sample Population, Size, Setting	Convenience sampling Population: 201 (out of 231) adult patients (≥ 18 years) admitted to the post-anesthesia care unit who had undergone elective non-cardiac, non-ambulatory surgery under general anesthesia Exclusion criteria: patients undergoing emergency procedures for which no preoperative data is available and patients requiring overnight mechanical ventilation Setting: University Hospitals Leuven in Belgium
Intervention Procedures	Control: use of original departmental PONV prophylaxis algorithm Intervention protocol: use of new, simplified departmental PONV prophylaxis protocol
Primary Outcome and Measures	Dependent variable: incidence of PONV within 1 to 24 hours after surgery Secondary outcomes: incidence of PONV within 1 to 24 hours post-op, whether risk stratification had been properly conducted during the preoperative evaluation, number of antiemetics administered per patient, use of rescue medication, and compliance with departmental algorithm for PONV prophylaxis DV measures: Provider compliance is defined as “the correct application of the algorithm i.e. whether or not the recommended prophylactic measures were administered”.
Results/Conclusions	Results: There was a statistically significant reduction ($P=0.02$) in the incidence of PONV within 24 hours after surgery after the implementation of a simplified PONV algorithm (22%) compared to before the simplification of the PONV algorithm (33%). However, the incidence of PONV within 1 hour of surgery was not significant between the two algorithms (11% vs 14%, $P=0.45$). In addition, the implementation of a simplified algorithm did not impact whether risk stratification had been properly conducted as pre-op determination of Apfel scores were conducted correctly in only 36% of patients before the implementation of the simplified algorithm, in which it was conducted correctly in 42% of patients ($p=0.21$). There was also a significant improvement in the compliance with the departmental algorithm for PONV prophylaxis. Conclusions: The authors conclude the implementation of a simplified PONV prophylaxis algorithm caused a significant and marked reduction in the incidence of PONV among patients as well as a significantly increased adherence to the new departmental PONV algorithm.

Citation: Devarakonda, B. V., Goel, A., Singh, S., Kumar Sreevastava, D., Vadapalli, K., & Mohan Reddy, M. (2022). Efficacy of evidence-based institutional protocol for prevention of postoperative nausea and vomiting: A prospective observational study. <i>Medical Journal Armed Forces India</i> , 78(1), 36–41. https://pubmed.ncbi.nlm.nih.gov/35035042/		Level and Quality: III-B
Purpose or Hypothesis	The purpose of this study is to determine if an evidence-based institutional protocol for PONV prevention leads to a decreased incidence of PONV as well as the correlation between adherence to the protocol and the prevalence of PONV.	
Type of Evidence Research Design	Prospective cohort study	
Sample Population, Size, Setting	Population: 227 adult patients (> 18 years old) undergoing elective noncardiac surgery at least 30 minutes long 117 patients in the control group and 110 in the intervention group	

	Exclusion criteria: patients undergoing emergency surgery, patients requiring ICU admission post-operatively, patients with intra- or post-operative hypotension, patients receiving chemotherapy or radiotherapy Setting: tertiary care hospital in Pune, India
Intervention Procedures	Control: incidence of PONV prior to the use of an institution-wide protocol for PONV prophylaxis Intervention protocol: the use of a newly developed institution-wide PONV guideline
Primary Outcome and Measures	Dependent variable: incidence of post-operative nausea and post-operative vomiting reported by patients Secondary outcome was the rate of anesthesia adherence to the PONV protocol DV measures: Nausea was defined as “an unpleasant feeling associated with the awareness of an urge to vomit” and vomiting was defined as “the forceful expulsion of gastric contents from the mouth”. Provider adherence to the PONV protocol “was said to be achieved when the ‘risk score’ and the ‘prophylaxis score’ were balanced to 0 or 1”.
Results/Conclusions	Results: A p-value <0.05 was considered statistically significant and there was a statistically significant (P=0.033) decrease in the incidence of post-operative nausea from 32.5% before the intervention to 20% after the intervention and a statistically significant decrease in the incidence of post-operative vomiting from 20.5% before the intervention to 9.1% after the implementation of the protocol. Furthermore, 78.2% of anesthesia providers adhered to the protocol and the incidence of post-operative nausea and post-operative vomiting in patients was “significantly less when antiemetics were administered based on adherence to the protocol than not (8.3% vs 57.7%, p < 0.001 and 3.6% vs 26.9%, p < 0.001, respectively).” Conclusions: There is a reduced occurrence of PONV when patients receive prophylaxis based on an evidence-based institutional protocol. There is a high rate of anesthesia provider adherence to an institutional PONV protocol due to the efforts made to increase compliance, including formal educational sessions on the PONV prophylaxis protocol and prominent display of the protocol throughout the ORs.

Citation: Pym, A., & Ben-Menachem, E. (2018). The effect of a multifaceted postoperative nausea and vomiting reduction strategy on prophylaxis administration amongst higher-risk adult surgical patients. <i>Anaesthesia and Intensive Care</i> , 46(2), 185–189. https://pubmed.ncbi.nlm.nih.gov/29519221/	Level and Quality: III-B
Purpose or Hypothesis	The purpose of this study is to determine if the promotion of an evidence-based PONV guideline and providing individualized adherence feedback and patient outcome to anesthesia providers improves the compliance with the PONV protocol.
Type of Evidence Research Design	Prospective cohort study
Sample Population, Size, Setting	Population: 581 patients undergoing general anesthesia who are transferred to the post-anesthesia care unit Exclusion criteria: patients who transferred to the intensive care unit post-operatively or who only received regional anesthesia or sedation Setting: St. Vincent’s Hospital in Sydney, Australia, an acute care facility in an urban setting
Intervention Procedures	Control: amount of PONV prophylaxis administered and patient PONV outcomes before an educational intervention and individual audits of provider’s performance Intervention protocol: an educational intervention that consists of an oral presentation of an evidence-based PONV guideline developed at the institution, email dissemination of the PONV guideline, and posters of the guideline throughout the ORs as well as individual audit data
Primary Outcome and Measures	Dependent variable: adherence to the PONV guideline by anesthesia providers for patients identified as medium to high risk

	<p>Secondary outcomes included reports of symptomatic PONV by patients and length of PACU stay</p> <p>DV measure: reports of symptomatic PONV is defined as patients experiencing retching or vomiting or reporting feeling nauseous and requiring rescue antiemetics. PACU duration of stay is defined as the time from which the patient is received in the PACU until they are deemed ready to be discharged from the PACU</p>
Results/Conclusions	<p>Results: There was a statistically significant ($p=0.004$) decrease in the PONV rate of patients in the post-intervention cohort versus that in the pre-intervention cohort. The PACU length of stay for all patients was not significantly shorter ($p=0.054$) in the post-intervention cohort than in the pre-intervention cohort.</p> <p>Conclusion: The results of the study uphold that the use of a PONV prophylaxis protocol, disseminating and presenting the protocol, and providing individual performance feedback increases antiemetic prophylaxis given to high risk patients.</p>

Citation: Williams, A., Stephenson, S. J., Jiwanmall, M., Cherian, N. E., & Kamakshi, S. (2021). Reduction in post-operative nausea and vomiting (PONV) by preoperative risk stratification and adherence to a standardized anti emetic prophylaxis protocol in the day-care surgical population. <i>Journal of Family Medicine and Primary Care</i> , 10(2), 865–870. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8138419/		Level and Quality: III-B
Purpose or Hypothesis	The purpose of this study is to determine the prevalence of PONV following the use of a standardized risk stratification tool and prophylaxis protocol.	
Type of Evidence Research Design	Prospective cohort study	
Sample Population, Size, Setting	<p>Population: 500 adult patients undergoing ambulatory surgery</p> <p>Exclusion criteria: patient refusal for participation, patients aged < 18 or > 60 years, ASA physical status of 3 or more, patients on chemotherapy, patients on palliative therapy with chronic opioid consumption, pregnant or lactating women, patients who received antiemetic treatment within 24 hours before surgery, patients with history of hepatic, renal, or cardiopulmonary comorbidities, patients with significant GI disorders</p> <p>Setting: tertiary care teaching institution in South India</p> <p>Power analysis: The authors determined a sample size of 300 was needed to meet a power analysis of 80%, $\alpha < 0.05$</p>	
Intervention Procedures	<p>Control: Use of simplified Apfel score to stratify patient risk and determine PONV prophylaxis treatment.</p> <p>Intervention protocol: Determining PONV prophylaxis treatment based on an exhaustive list of patient risk factors.</p>	
Primary Outcome and Measures	<p>Dependent variable: number of episodes of PONV and time to occurrence of PONV episode</p> <p>Secondary outcomes included severity of vomiting and retching as well as duration of observation in the PACU</p> <p>DV measures: episodes of PONV include the occurrence of vomiting or retching; severity of vomiting or retching is determined by the number of vomiting or retching events occurring at least one minute apart</p>	
Results/Conclusions	<p>Results: Statistically significant risk factors for PONV include previous history of nausea ($P=0.019$), history of alcohol consumption ($P=0.037$), increased duration of surgery ($P=0.0522$), and higher BMI ($P=0.05$). The researchers found the prevalence of post-operative nausea was 2.04% (CI 1.1 to 3.6) and post-operative vomiting was 2.45% (CI 1.4 to 4.1) when anesthesia providers administered antiemetics based on number of risk factors according to the Apfel scoring system.</p> <p>Conclusions: The writers conclude the lower prevalence of PONV in their study population (compared with reported PONV prevalence values of 20% to 50% from other cited cohort studies) is due to adherence to the risk stratification tool and use of antiemetics based on risk stratification.</p>	

Citation: Greene, N. H., Norstedt, P. A., Nair, B. G., & Souter, K. J. (2015). Systematic postoperative nausea prophylaxis feedback improves clinical performance in anesthesiology residents. <i>Journal of Education in Perioperative Medicine</i> , 17(3). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5131259/		Level and Quality: II-C
Purpose or Hypothesis	The purpose of this study is to determine if communicating provider adherence to a system-wide PONV prophylaxis protocol will improve their compliance to the protocol.	
Type of Evidence Research Design	Prospective cohort study using patients assigned to an RCT (Quasi-experimental)	
Sample Population, Size, Setting	Primary Population: 13 second-year anesthesia residents Secondary Population: unspecified number of females under the age of 50 years old undergoing gynecological surgery, cholecystectomy, or breast surgery Setting: University of Washington Medical Center in Seattle, WA	
Intervention Procedures	Control: compliance to PONV prophylaxis prior to educational intervention and individualized resident feedback of performance Intervention protocol: educational intervention provided to anesthesia residents that consists of a short lecture reviewing risk factors and prophylactic interventions for PONV as well as the implementation of performance feedback regarding anesthesia resident's compliance to PONV prophylaxis.	
Primary Outcome and Measures	Dependent variable: compliance of anesthesia residents with a PONV prophylaxis protocol DV measure: The number of antiemetic interventions used for each operative case of the anesthesia residents and the anesthesia resident was considered compliant if two or more antiemetics were administered.	
Results/Conclusions	Results: A two-sample t-test reveals a statistically significant p-value of 0.001. The compliance of anesthesia residents before the intervention was 38% compared to 73% post intervention. Conclusion: Auditing compliance and providing individual feedback of compliance to the anesthesia resident increases the number of antiemetics given to patients. Additionally, high risk patients receive more antiemetic treatment since providing anesthesia residents with performance feedback.	

Citation: Wood, M., Hall, L., Hockenberry, M., & Borinstein, S. (2015). Improving adherence to evidence-based guidelines for chemotherapy-induced nausea and vomiting. <i>Journal of Pediatric Oncology Nursing</i> , 32(4), 195–200. http://survey.hshsl.umaryland.edu/?url=https://search-ebshost-com.proxy-hs.researchport.umd.edu/login.aspx?direct=true&db=rzh&AN=103222827&site=ehost-live		Level and Quality: V-B
Purpose or Hypothesis	The purpose of the authors was to improve adherence to evidence-based chemotherapy-induced nausea and vomiting (CINV) among providers	
Type of Evidence Research Design	Quality improvement study	
Sample Population, Size, Setting	Population: the prescribing providers within the oncology division including 13 attending physicians, 6 physicians completing a hematology/oncology fellowship, and 3 nurse practitioners Setting: comprehensive pediatric cancer center in the southeast United States	
Intervention Procedures	Control: chart review of chemotherapy orders during a 12-week period prior to the intervention for adherence to the CINV guidelines	

	Intervention protocol: creation and introduction of CINV guidelines to providers and staff nurses and provider notification of non-adherence to antiemetic guidelines
Primary Outcome and Measures	Dependent variable: prescriber adherence to CINV guidelines following the creation and implementation of the standardized guidelines DV measures: the operational definition of provider adherence, according to the authors, is the “number of chemotherapy orders with correct antiemetics ordered”
Results/Conclusions	Results: Fisher’s exact test results showed an insignificant decrease in the number of incorrect antiemetics ordered by prescribers from before the intervention to after the intervention (13% vs 5.26%, $p = 0.30$). The authors determined an increase in prescriber adherence to the CINV guidelines from 87% to 95%, despite it being statistically insignificant. Conclusion: The authors conclude the need for continued reinforcement of CINV guidelines after implementation of the intervention. The authors also conclude an increase in provider adherence rates when direct provider feedback given.

Table 2

Evidence Synthesis Table

Project Title: Increasing CRNA Adherence to a PONV Protocol to Decrease PONV Among Patients			
JHNEBP Model Level	Total Number of Sources	Author and Quality Rating of each study	Synthesis of Findings
<p>Level I Experimental study · Randomized Controlled Trial (RCT) · Systematic review of RCTs with or without meta-analysis</p>	1	Ma et al.: A	This article was the highest level of evidence against which all other articles are compared. The findings of this article are consistent with those of the other articles which show a significant decrease in the incidence of post-operative nausea and vomiting when anesthesia providers prescribe and administer antiemetics based on patients' individualized risk stratification (2022).
<p>Level II Quasi-experimental studies · Systematic review of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only, with or without meta-analysis</p>	1	Dewinter et al.: B	This article uniquely compared the incidence of post-operative nausea and vomiting and the compliance of providers to a protocol based on two algorithms, with the main difference between the algorithms being PONV prophylaxis and treatment are determined by patient gender in the simplified algorithm (2017). Nonetheless, the findings point to increased compliance to and a decrease in the incidence of PONV with a simplified, easy-to-follow algorithm for PONV prophylaxis (2017).
<p>Level III Non-experimental study · Systematic review of a combination of RCTs, quasi-experimental, and non-experimental studies, or non-experimental studies only, with or without meta-analysis · Qualitative study or systematic review of qualitative studies with or without meta-synthesis</p>	4	Devarakonda et al.: B Greene et al.: C Pym et al.: B Williams et al.: B	Devarakonda et al. (2022), Pym et al. (2018), and Williams et al. (2021). all found a lower incidence of PONV occurred when providers selected and administered antiemetics based on patient risk factors and Williams et al. determined the more extensive the risk stratification, the more prophylactic treatment that could be administered and the lower the incidence of PONV. Both Greene et al. (2015) and Pym et al. discuss the significance of auditing provider compliance and giving providers individualized feedback on their compliance or patient outcomes increases anesthesia providers' adherence to standardized PONV

			prophylaxis protocols. Lastly, both Devarakonda et al. and Pym et al. also find increased dissemination of an institution’s PONV prophylaxis protocol via continuing education and/or displaying of the protocol also increase provider adherence to the protocol.
Level IV Opinion of respected authorities and/or reports of nationally recognized expert committees/consensus panels based on scientific evidence			
Level V Evidence obtained from literature reviews, quality improvement, program evaluation, financial evaluation, or case reports · Opinion of nationally recognized expert(s) based on experiential evidence	1	Wood et al.: B	While this was a lower level publication and it focused on provider adherence to a chemotherapy-induced nausea and vomiting protocol, the findings of Wood et al. (2015) paralleled those of Devarakonda et al. (2022), Pym et al. (2018), and Williams et al. (2021) in that provider compliance with a nausea/vomiting prophylaxis protocol increased with continued reinforcement of the protocol (whether through ongoing educational sessions or displaying posters of the protocol) and with giving providers feedback on their performance on PONV treatment.
Overall Quality Rating w/ rational and Recommendation: The overall quality rating of the evidence is a level III-B. While the article by Ma et al. (2022) provided strong evidence for the use of a protocol to manage the incidence of post-operative nausea and vomiting, the remaining articles were of lower qualities, with the majority of them being level III-B publications. The recommendation based on the evidence synthesis is good and consistent, pointing to a practice change. However, due to the overall quality rating of the evidence, it would be prudent to consider the risk versus benefits of implementing a practice change that aims to decrease the incidence of PONV driven by increased provider compliance with a PONV prophylaxis protocol.			

Table 3*Site Team Table*

Team Member Name/Credentials/Title	Responsibilities
1. Rebecca Brave, SRNA Project Lead	Obtaining and presenting research findings regarding the importance and impact of the project; planning and executing project implementation; mobilizing team members; organizing meetings; collecting data; assess and evaluate QI project outcomes
2. CRNA Clinical Site Representative	Collaborates with Project Lead to obtain information about tracking provider compliance to existing protocol, scheduling staff meetings to promote the goals of the project, facilitates communication between Project Lead and other stakeholders
3. Site Sponsor	Head of Anesthesia Department; approves or denies project; leverages position and influence to obtain resources and overcome barriers to project
4. Dr. Johnny Gayden, CRNA Faculty Advisor	Advises and provides guidance to Project Lead throughout development, execution, and evaluation of QI project; evaluates Project Lead's performance
5. Director of Clinical Nursing Informatics	Provides electronic information pertinent to anesthesia provider PONV protocol compliance rates and tabulation of patient reports of PONV per PACU documentation. Also provides assistance in the creation and execution of a PONV risk stratification section in the pre-existing pre-anesthesia evaluation used by anesthesia providers.

Figure 1

Fishbone of Root Cause Analysis for PONV

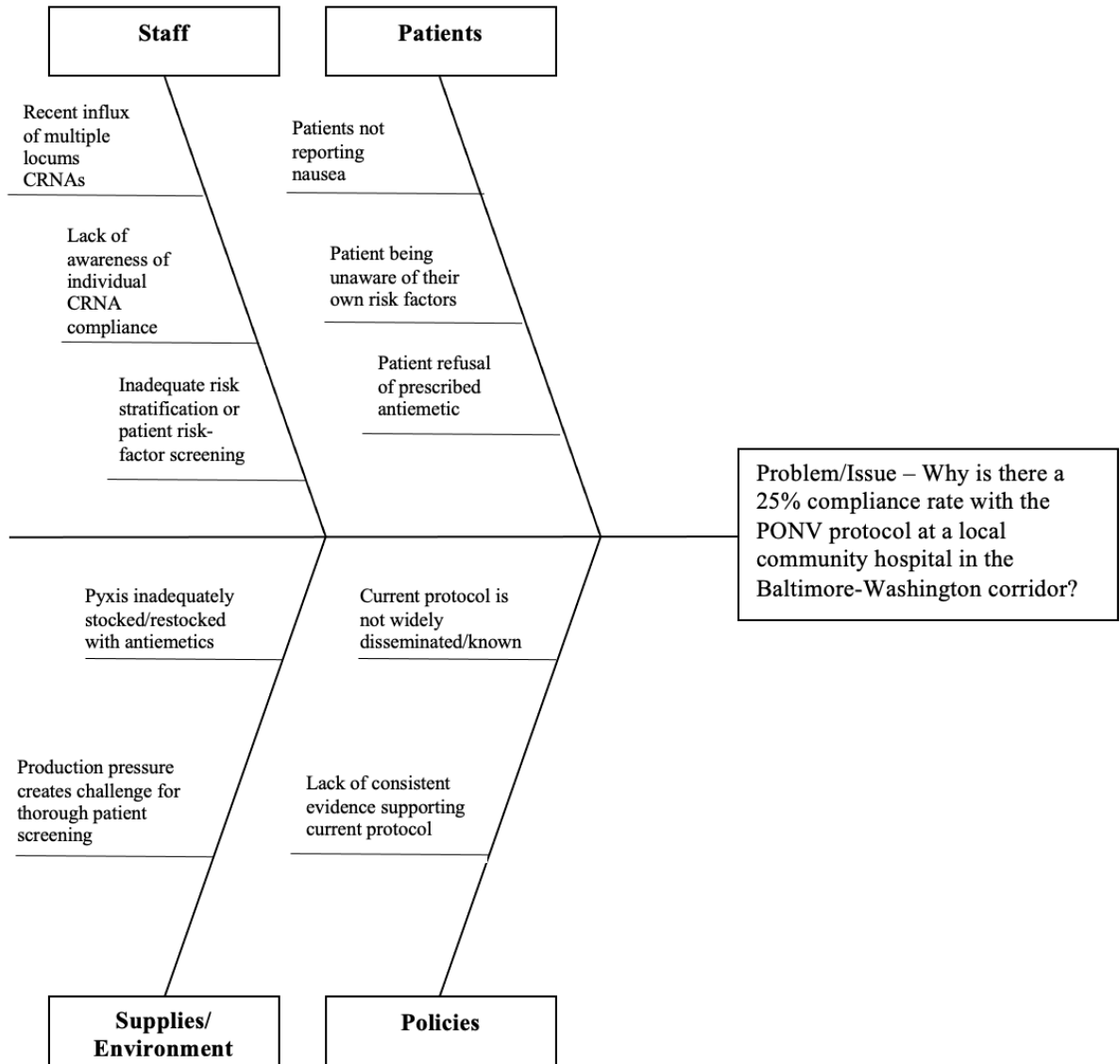
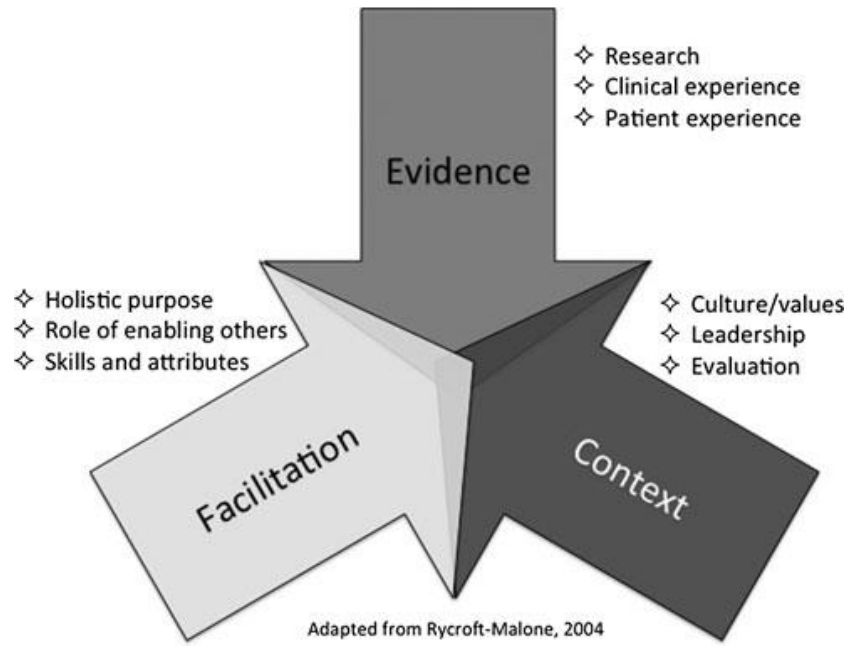


Figure 2

PARiHS Framework



(Glegg et al., 2016)

Figure 3

PONV Prophylaxis Protocol

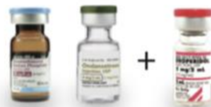
0-1 Risk factors

- Dexamethasone 4 mg IV shortly after induction **AND**
- Ondansetron 4 mg IV prior to emergence.



2 Risk factors

- Add droperidol 0.625 mg IV prior to emergence.



3 Risk factors

- Add scopolamine patch prior to induction.



4 Risk factors

- Add aprepitant 40 mg PO prior to induction **OR**
- Add fosaprepitant 150 mg IV shortly after induction.



5 Risk factors

- Add propofol infusion. Either 25 mcg/kg/min and decrease volatile anesthetic, or as part of a TIVA.



** If any of the above medications are not available or contraindicated, then the next in line should be used.

MAC procedures

If narcotic is used, then patient should receive dexamethasone 4 mg IV early and ondansetron 4 mg IV late.



Risk factors

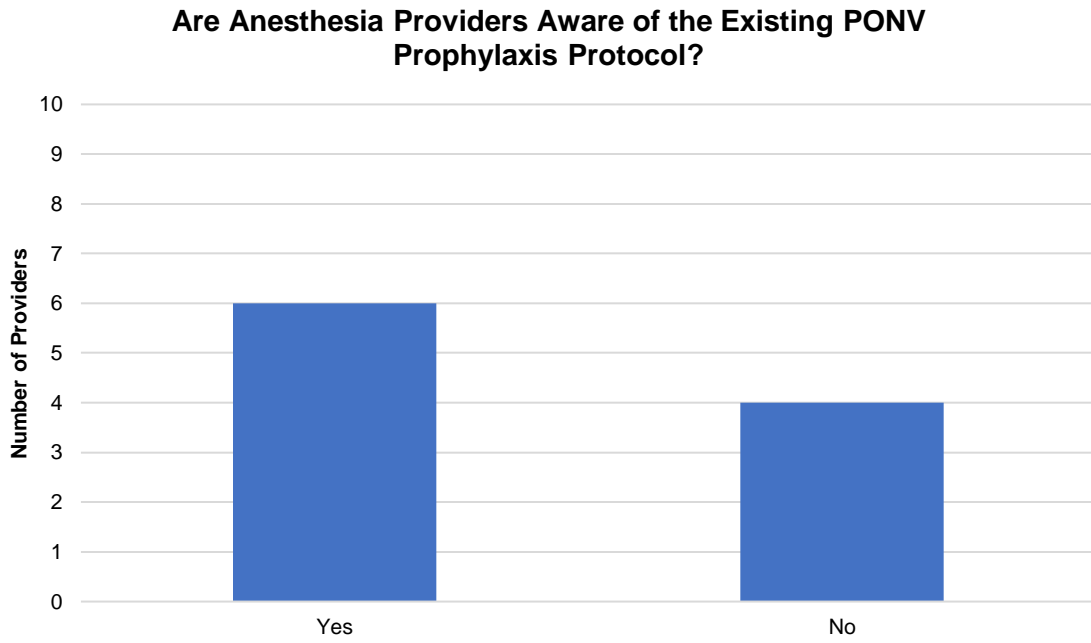
in decreasing order of impact

1. Female genotype
2. High risk surgery (laparoscopic, bariatric, GYN, cholecystectomy)
3. Volatile anesthetic
4. History of PONV or motion sickness
5. Non-smoking status

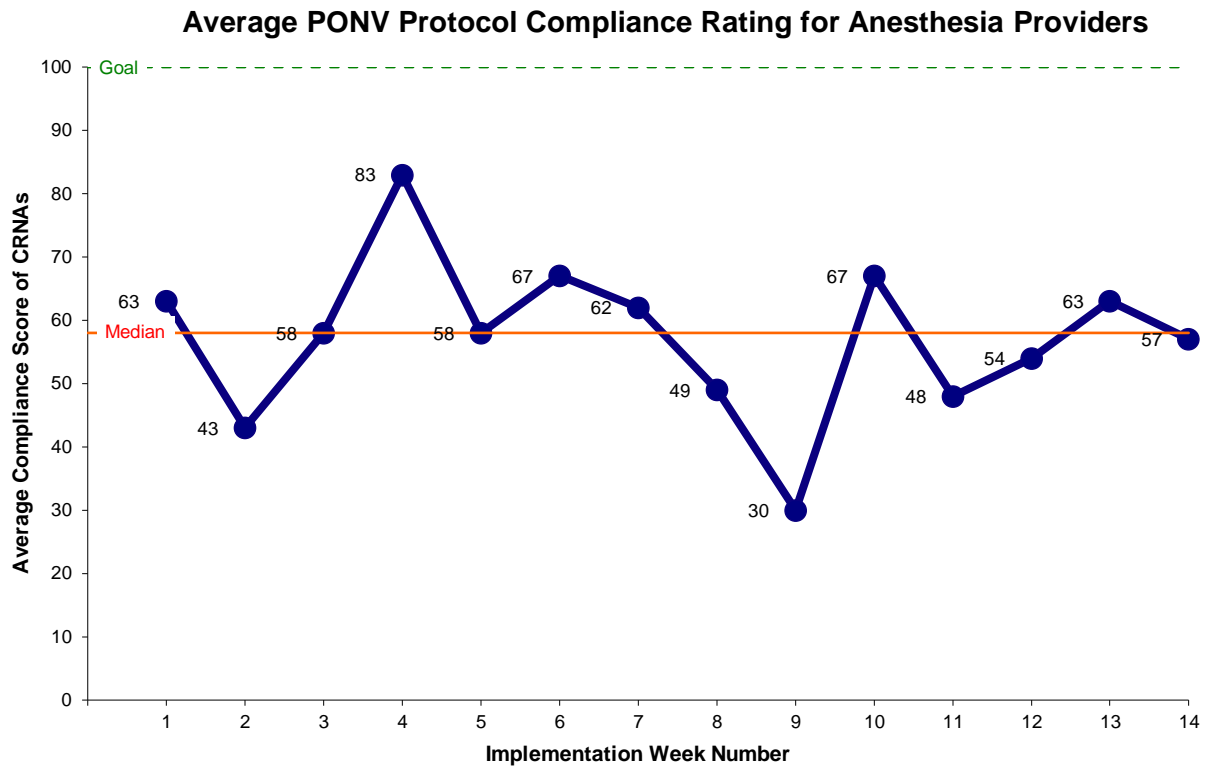
Additional information

- Dexamethasone 4 mg IV does not impact glycemic management in patients with diabetes.
- Droperidol 0.625 mg has the same impact on QTc as ondansetron 4 mg IV.
- Scopolamine, aprepitant and fosaprepitant have a 3-4 hour length of onset.

Appendix A: Results of Provider Knowledge of PONV Protocol Staff Survey



Appendix B: Run Chart



Annotation: After week 4, there was a change in how often the provider compliance scores were made available on the PONV Dashboard.

Appendix C: Patient Incidence of PONV

Percentage of Adult Ambulatory Surgical Patients who had General Anesthesia and Report PONV within Four Hours of End of Surgery

