Implementation of Postoperative Nausea and Vomiting Guidelines for Female Adult Patients Undergoing Anesthesia During Gynecologic and Breast Surgery in an Ambulatory Setting

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Purpose: *Postoperative nausea and vomiting (PONV) is one of the most common complications after anesthesia. This evidence-based quality improvement (QI) project describes the implementation of a PONV guideline and the impact on providers' compliance with PONV risk assessment using the Apfel PONV score.*

Design: *A retrospective preimplementation and postimplementation QI project.*

Methods: *This evidence-based QI project sample included 294 adult female patients scheduled for gynecologic or breast surgery in the ambulatory setting. They were observed for PONV in the postanesthesia care unit. In addition, compliance of Apfel risk-assessment score documentation on the preanesthesia evaluation form was assessed.*

Findings: *Postimplementation of the guideline, the overall incidence of PONV was significantly lower (9.5% vs 21.1%,* P = *.009) and anesthesia providers' adherence to Apfel risk score documentation significantly increased (63.3% vs 49%,* P = *.019).*

Conclusions: *A PONV guideline for gynecologic and breast surgery can reduce the PONV incidence and improve anesthesia providers' compliance with PONV risk assessment and its documentation.*

Keywords: *postoperative nausea and vomiting, PONV risk screening, female patients and PONV, patient satisfaction, quality improvement.*

POSTOPERATIVE NAUSEA AND VOMITING (PONV) is one of the most common complications after surgery and anesthesia with a reported incidence from 30% in the general postsurgical population to 80% in high-risk patients.[1,2] It is defined as nausea or nausea and vomiting occurring during the first 24 to 48 hours after surgery and anesthesia.[3] Researchers concur that

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female gender is the strongest overall predictor of PONV followed by a patient predictor of a history of PONV or motion sickness. Females have a more than two and half times greater risk of experiencing PONV than males.[2,4-6] Breast surgeries and gynecologic (GYN) surgeries are both associated with a high incidence of PONV, with a reported 80% of patients experiencing PONV during the first 24 hours in the absence of prophylactic antiemetic therapy.[7,8] The incidence of PONV for adults generally decreases with age.[4,9] Bakshi et al[10] reported a higher incidence of PONV in patients aged less than 50 years who underwent breast surgery. In addition, women who experience PONV report higher levels of pain in the postanesthesia care unit (PACU) and thus receive more opioids than those women who do not experience PONV.[7] The need for increased pain management in the form of opioids results in an increased risk for postdischarge nausea and vomiting.

PONV leads to patient suffering, dissatisfaction, and an increase in medical costs as a result of delayed PACU discharge, prolonged need for nursing care, and the risk of unanticipated hospital admission after ambulatory surgery.[4,11] According to the Healthcare Cost and Utilization Project in 2014, 57.8% of all surgeries in the United States were performed in an ambulatory setting.[12] A multicenter cohort study of patients undergoing ambulatory surgery under general anesthesia (GA) in the United States reported 37% of patients experienced postdischarge nausea and vomiting.[13] The estimated costs of PONV in the ambulatory surgical setting can range from $250,000 to $1.5 million in lost surgical revenue.[14,15]

Literature Review

To address PONV effectively, patients at risk should be identified preoperatively. PONV risk-assessment screening allows for the facilitation of targeted antiemetic prophylaxis and provides useful information for predicting PONV within 24 hours postoperatively.[2,5,6,16] The simplified Apfel risk score is a validated and widely used method for identifying patients at risk for PONV. The risk score is derived from four factors: female gender, a history of PONV or motion sickness, smoking status, and the need for postoperative opioids.[4] A score of "1" is given for each risk category the patient presents. The patient's total Apfel risk score will range from 0 (no risk) to 4 (high risk).[2,4,6] Identifying the patient's Apfel risk score can prompt interdisciplinary conversation among providers to consider the appropriate PONV prophylaxis treatment options for high-risk patients before the start of anesthesia. Factors such as increased workload, documentation error, and provider's disagreement with the validity of the risk score have been shown to result in providers' nonadherence and failure to appropriately document patients' risk scores.[17]

The Society for Ambulatory Anesthesia (SAMBA) compiled evidenced-based guidelines to inform the current anesthesia practice on PONV management.[2,14] They recommend identifying patients at risk for PONV, identifying the most effective antiemetic single therapy and combination therapy regimens for PONV prophylaxis, the administration of two or more pharmacologic interventions for adults at high risk for PONV, ensuring that PONV prevention and treatment are implemented in the clinical setting, and the facilitation and use of multimodal PONV prevention guidelines and algorithms for surgical patients.[2]

Despite the existence of these guidelines, PONV remains a significant problem in the clinical setting, especially in ambulatory surgery.[18] A study by Napadow et al[19] described the origin of nausea centers in the brain with a variety of neurotransmitters and hormones responsible for the sensation of nausea. The primary control of nausea and vomiting arises from the patients's emetic center located in the medulla oblongata. The five major receptor systems involved in PONV are the chemoreceptor triggering zone, the vagal mucosal pathway in the gastrointestinal system, the reflex afferent pathway from the cerebral cortex, the neuronal pathways from the vestibular system, and midbrain afferents activity.[19,20] Stimulation of one of these afferent pathways can activate the vomiting center via the cholinergic, dopaminergic, histaminergic, or serotonergic receptors.[19,21] Multimodal therapy is a better alternative to manage the multitude of inputs and signals that result in nausea and vomiting.[22] Consequently, multimodal approaches to PONV consist of two or more

antiemetic therapies targeting the different pathways have been highly recommended for patients at high risk for PONV.[23]

Algorithms that describe how to identify high-risk patients and how to guide the administration of multimodal treatments can significantly reduce the incidence of PONV.[1,24-26] This includes identification of PONV risk by using the Apfel risk score and developing a targeted therapy with one or more antiemetics based on the patient's risk assessment.[27] Brookes et al[24] evaluated the efficacy of a multimodal approach to reduce PONV after Le Fort 1 osteotomy and concluded that a reduction in the incidence of nausea and the elimination of vomiting in high-risk outpatients is possible with a multimodal antiemetic regimen. The incidence of PONV in high-risk patients is significantly lower in groups who received multimodal antiemetic therapy when compared with those who received a single pharmacologic antiemetic[28,29] such as the use of preoperative or intraoperative administration of midazolam, scopolamine, or dexamethasone.[30,31]

The anesthesia providers' understanding, assessment, and proper treatment of PONV are critical to allow for optimal management of PONV in patients undergoing surgery and anesthesia. The lack of a defined protocol to identify and treat PONV coupled with its high incidence in our female surgical population provided a framework to explore solutions to this postoperative problem. A team of anesthesia providers was formed to review the literature on patient-tailored PONV prophylaxis strategies, evaluate ways to improve Apfel risk-assessment documentation, and improve our patients' experience in the PACU.

The purpose of this evidence-based quality improvement (QI) project was to implement an evidence-based guideline for the management of PONV in female adults undergoing GYN and/or breast surgery and anesthesia in an ambulatory setting, and to measure changes in the anesthesia providers' compliance with documentation of the Apfel risk score assessment as a means to guide PONV prophylaxis. The aims of this project were to (1) assess the preimplementation incidence of PONV in female patients undergoing GYN and/or breast surgery in the ambulatory setting; (2) develop an educational intervention regarding PONV prophylaxis, (3) assess the postimplementation incidence of PONV in females undergoing GYN or breast surgery within the first 8 hours of admission to the PACU; and (4) assess the anesthesia providers' compliance with documentation of the Apfel risk score assessment in their preoperative evaluation of the patient.

Methods

Study Design and Ethical Consideration

This was a preimplementation and postimplementation QI project to evaluate the impact of an evidence-based PONV guideline. This QI project was exempted from Institutional Review Board approval of the sponsoring institution.

Organizational Setting

The setting for this QI initiative was a major multicampus teaching hospital in the northeastern United States. Approximately 30,000 ambulatory outpatient surgeries were performed in this hospital system in 2017. The project was conducted in the perioperative period and included the preoperative area, operating rooms (ORs) designated for GYN and breast surgical cases, and the PACU of one surgical campus. The department of anesthesiology provides anesthetics for approximately 300 GYN surgery cases and 100 breast surgery cases per month. Patients presenting for outpatient ambulatory surgery undergo preoperative evaluation and preparation by the anesthesiology and nursing staff in the preoperative holding area before transferring to the OR. Postoperatively the patients are admitted to the PACU.

Sample

The sample for this QI initiative was categorized as a convenience sample of adult female patients who underwent GYN or breast surgery and anesthesia in the ambulatory setting and who were expected to be discharged postoperatively. Inclusion criteria included women between the ages of 18 and 75 years, presenting for an ambulatory GYN or breast surgery and receiving either monitored anesthesia care (MAC) or GA as the primary anesthetic technique. Patients who required admission to the hospital and those who required postoperative mechanical ventilation were excluded from the study.

Implementation

PONV GUIDELINE CREATION AND USE. The development of the PONV guideline required the nurse to examine several steps important to the QI initiative, including a search for existing institutional PONV guidelines, a literature review, an organizational assessment, and most importantly a collaboration among and input from the PACU nurses, pharmacists, and anesthesia providers. A departmental PONV guideline was created as an evidence-based clinical guideline for the management of PONV in GYN and/or breast surgery in the ambulatory setting. The guideline was customized to address the female population undergoing GYN or breast surgery. It incorporated the Apfel risk assessment and multimodal antiemetic prophylaxis based on PONV risk assessment.

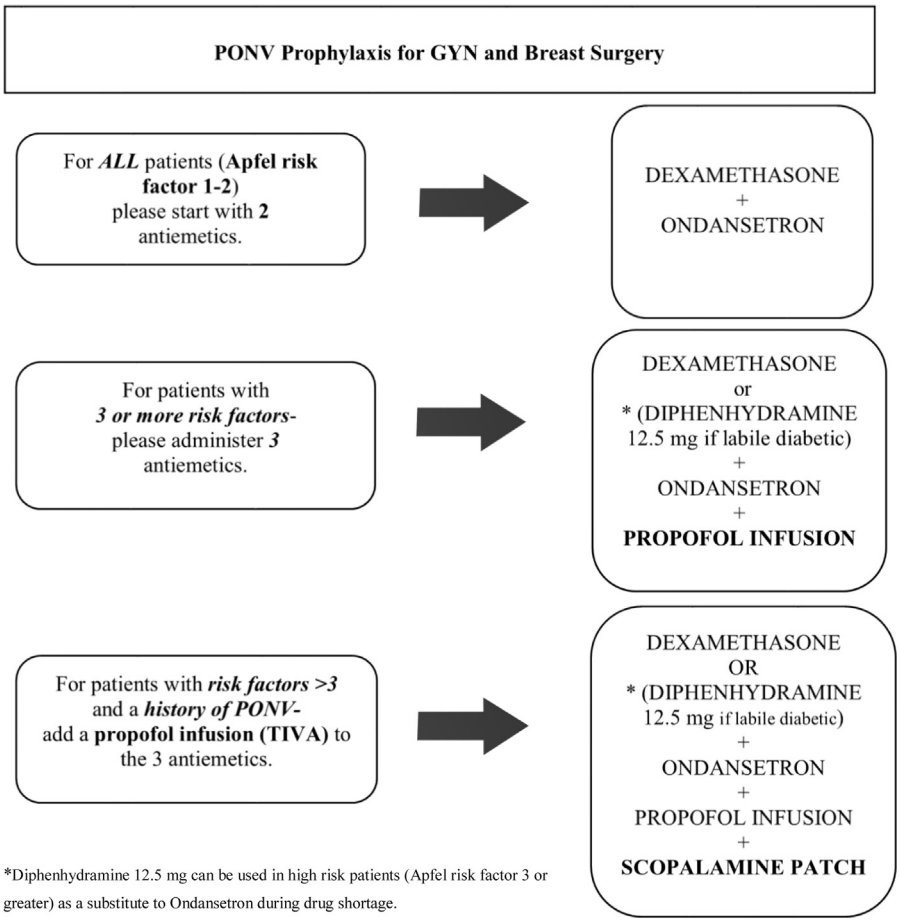
The first step of implementation was to identify and educate the stakeholders about the importance of the PONV guidelines. The choice of medications recommended in the PONV guidelines was based on the Cochrane review of PONV guidelines in an ambulatory setting, SAMBA, and the Consensus Guideline for the Management of Postoperative Nausea and Vomiting.[2,14] The staff educational intervention included a presentation about PONV, its causes, risks, and potential treatment options. Preimplementation data results were presented to providers in the monthly departmental practice committee meeting. After the in-person presentation, an electronic communication to share the educational presentation and results of the preimplementation data was shared with members of the practice committee. The organizational factors that may potentially affect the guideline's use and adoption were assessed in collaboration with two on-site anesthesiologists involved in the implementation and management of this QI project. The OR workflow assessment included the OR pharmacy manager to determine cost and accessibility of the medications recommended in the PONV guideline.

The PONV guideline was presented and included the recommendations of evidence-based PONV prophylaxis medications based on the patient's Apfel risk score (Figure 1). On the basis of the preoperative Apfel risk score, the guideline was implemented as follows: an Apfel risk score of 1 or 2 suggests administration of two antiemetics (dexamethasone and ondansetron); an Apfel risk score of 3 suggests the provider administer three antiemetics (ondansetron, propofol infusion, and dexamethasone or diphenhydramine 12.5 mg if a labile diabetic); and an Apfel risk score greater than 3 and a history of PONV suggests the provider additionally administer a propofol infusion (total intravenous anesthesia [TIVA]). This PONV protocol outlined an action required at each Apfel risk level (1 to 4).

STAFF EDUCATION. An educational session for anesthesia providers was held during the department's weekly grand rounds. Findings from the preimplementation period, which included the rate of PONV and the anesthesia providers' compliance with documentation of the preoperative Apfel risk score were reported. A review of the approved guidelines was presented. Laminated copies of the guidelines were placed on the anesthesia carts in each OR where GYN and breast surgeries were performed. Additional copies were distributed in both the preoperative holding area and the PACU. A copy of the PONV guideline was also sent to all providers via email.

Data Collection

A convenience sample of 147 preimplementation and 147 postimplementation patients' charts was reviewed via the Electronic Patient Information Center and Allscripts software of the project facility. The following data were retrieved from the preoperative anesthesia evaluation document: the patient's age, surgical procedure (GYN or breast), anesthetic technique (GA, TIVA, MAC, regional), the documented Apfel risk score, preoperative administration of an antiemetic, administration of a rescue antiemetic given for prophylaxis and treatment for PONV (metoclopramide, diphenhydramine, dexamethasone, lorazepam, ondansetron) in the PACU, unexpected admission to the hospital as a result of PONV (yes or no), and the administration of an antiemetic in the OR, the number of antiemetic(s) in the OR, and type of antiemetics given in the OR. The patient was considered to have PONV if a rescue antiemetic was administered and documented within the first 8 hours of admission to the PACU.



Risk Factors	Points
Post-Operative Opioids	1
Non-Smoker	1
Female Gender	1
History of PONV/Motion Sickness	1
Risk Score = Sum	0-4

Figure 1. PONV prophylaxis medications based on the patient's Apfel risk score. GYN, gynecologic; PONV, postoperative nausea and vomiting.

Statistical Analysis and Outcome Measures

Descriptive statistics were compared between the preimplementation and the postimplementation groups using appropriate statistical testing. Compliance was analyzed between the preimplementation and the postimplementation groups using χ^2 and Fisher's exact tests. Descriptive statistics (N, %) were computed to determine the anesthesia providers' compliance with the documentation of the Apfel risk score assessment. All data were analyzed using IBM SPSS Statistic Software, version 24 (IBM Corp, Armonk, NY). Levels of significance were set at $P < .05$.

Results

Sample and Demographics

The project included 294 patients who met the inclusion criteria. There were 147 patients in the preimplementation period and 147 patients in the postimplementation period. Descriptive statistics are summarized in Table 1. The population

Table 1. Descriptive Statistics of the Female Adult Patients Undergoing Anesthesia During Gynecologic and Breast Surgery in an Ambulatory Setting

	Total Population	Preimplementation N = 147	Postimplementation N = 147	Significance *P*
Age/y, Mean (SD)	294	45.14 (12.60)	45.67 (12.91)	.934
Procedure type, N (%)				
GYN	210 (71.4)	107 (72.8)	103 (70.1)	.699
Breast	84 (28.6)	40 (27.2)	44 (29.9)	.699
Apfel risk score				
1	8 (2.7)	2 (1.4)	6 (4.1)	.282
2	107 (36.4)	46 (31.3)	61 (41.5)	.089
3	117 (39.8)	61 (41.5)	56 (38.1)	.634
4	62 (21.1)	38 (25.9)	24 (16.3)	.063
Anesthesia type				
MAC	201 (68.4)	98 (66.7)	103 (70.1)	.616
General	93 (31.6)	49 (33.3)	44 (29.9)	.616

GYN, gynecologic; MAC, monitored anesthesia care.

was female and the mean age of the total population was 45 years. The preimplementation group consisted of 107 GYN and 40 breast surgery patients and the postimplementation group consisted of 103 GYN and 44 breast surgery patients. Overall, the two samples did not differ significantly with regards to age, type of anesthesia, or type of case (GYN vs breast).

PONV Incidence

Table 2 summarizes the descriptive statistics of the sample who experienced PONV in the PACU. In the preimplementation group, 21.1% of the patients experienced PONV within the first 8 hours of their admission to the PACU. Patients who experienced PONV in the preimplementation period presented as GYN surgical cases (74.2%) and breast surgical cases (25.8%). The anesthetics received were MAC (32.3%) and GA (67.7%). Patients in the postimplementation period, who experienced PONV, were 64.3% GYN cases and 35.7% breast cases. The incidence of PONV in the postimplementation was 9.5% and 28.6% of patients received MAC whereas 71.4% received GA. Those who received GA had significantly higher rates of PONV compared with those patients who received MAC anesthesia

Table 2. Descriptive Statistics of the Female Adult Patients Undergoing Anesthesia During Gynecologic and Breast Surgery in an Ambulatory Setting Who Experienced PONV in the PACU

	Total population = 294	Preimplementation = 147	Postimplementation = 147	Significance *P*
PONV in the PACU				
No, N (%)	249 (84.7)	116 (78.9)	133 (90.5)	
Yes, N (%)	45 (15.3)	31 (21.1)	14 (9.5)	.009*
Procedure type, N (%)				
GYN	32 (71.1)	23 (74.2)	9 (64.3)	
Breast	13 (28.9)	8 (25.8)	5 (35.7)	.502
Anesthesia type, N (%)				
MAC	14 (31.1)	10 (32.3)	4 (28.6)	.805
General	31 (68.9)	21 (67.7)	10 (71.4)	

GYN, gynecologic; MAC, monitored anesthesia care; PACU, postanesthesia care unit; PONV, postoperative nausea and vomiting.

*$P < .05$.

Table 3. PONV Prevalence—Anesthesia Type by Project Period

	MAC, N = 98	GA, N = 49	Significance *P*
Preimplementation N (%)	10 (10.2)	21 (42.9)	< .001*
	MAC, N = 103	**GA, N = 44**	
Postimplementation N (%)	4 (3.9)	10 (22.7)	.001*

GA, general anesthesia; MAC, monitored anesthesia care; PONV, postoperative nausea and vomiting.
*$P < .05$.

($P = .001$) (Table 3). The incidence of PONV significantly decreased from 21.1% in the preimplementation period to 9.5% in the postimplementation period ($P = .009$).

Apfel Risk Score Documentation

The overall compliance with documentation of the Apfel risk score documentation increased significantly from the preimplementation period (49%) to the postimplementation period (63.3%) ($P = 0.019$). There was a statistically significant increase in the percentage of anesthesia providers charting the correct Apfel score from 58.3% in the preimplementation period to 74.2% in the postimplementation period ($P = .044$) (Table 4).

Discussion

The goal of this project was to implement an evidence-based guideline for the management of PONV in female adults undergoing anesthesia for GYN or breast surgery to reduce the incidence of PONV. It is important for an anesthesia provider to be aware of his or her current practice regarding PONV assessment and treatment before implementation of a new clinical protocol. A clinician's lack of awareness and doubts about the effectiveness of clinical guideline practice can be considered a barrier to the adherence of clinical guideline practices among practitioners. This project sought to increase the anesthesia providers' compliance with the Apfel risk score documentation to aid providers to predict those at risk for PONV. To accomplish this goal, an algorithm based on the recommendations of the Consensus Guidelines for the Management of Postoperative Nausea and Vomiting[2] was created to guide anesthesia providers with effective treatment strategies (single therapy, combination therapy, and multimodal) based on each patients' Apfel risk score.

It is important for anesthesia providers to be aware of their current state of practice regarding PONV before implementation of the new practice protocols. The use of PONV guidelines to decrease the incidence of PONV in the clinical setting is well documented in the literature.[1,2,24,25,27,31,32] Clinical guidelines can improve the quality of clinical decision-making and improve outdated practice by providing current and comprehensive information important to the practice of anesthesia. The use of PONV risk scores has demonstrated effectiveness in reducing the rates of PONV as it provides a tool for the assessment of patient-specific factors, which predict the patient's underlying susceptibility to PONV.[6] The educational strategy associated with the implementation of this project increased the anesthesia provider's attention to the issue of

Table 4. Apfel Risk Score Documentation Compliance by Project Period

	Total N = 294	Preimplementation N = 129	Postimplementation N = 165	
Apfel Documentation	**N (%)**	**N (%)**	**N (%)**	**Significance *P***
Apfel Charted	165 (56.1)	72 (49)	93 (63.3)	.019*
Correct Apfel Score	111 (67.3)	42 (58.3)	69 (74.2)	.044*

*$P < .05$.

PONV for this population. This was supported by a 29% increase in the compliance with Apfel risk score documentation from the preimplementation to postimplementation period.

There was a statistically significant increase in the anesthesia providers' correct determination and documentation of the Apfel risk score between the preimplementation and the postimplementation period. Kumar et al[33] emphasized there is a risk of sustainability to PONV protocols if compliance of providers is low. The potential limitation of guidelines and a contributing factor to PONV is the low adherence to protocol by providers.[2,17] Several studies suggest the importance of including clinical decision tools or hard stops as automated reminders in the electronic medical record. The use of hard stops requires providers to specify a reason for nonadherence.[17,34,35] In our population, the incidence of PONV was reduced from 21.1% preimplementation to 9.5% postimplementation, a 57.6% decrease. The resultant administration of prophylactic antiemetics resulted in a lower PONV incidence, particularly in high-risk patients, translating into an improved patient experience and resulting in reduced cost for the health system and the patient.

It is important to examine the patients who experienced nausea and vomiting to understand how the use of this guideline impacts the occurrence of PONV and translates into practice changes. For instance, the use of volatile anesthetics is considered the single most important factor for predicting PONV in the first 2 hours after PACU admission with an associated twofold increase.[3] Apfel et al[36] suggest that volatile anesthetics are the leading cause of early PONV (0 to 2 hours). Patients who experienced PONV in both the preimplementation and postimplementation periods were predominately patients who received GA. This finding is important to continue to examine and may allow for an expansion of the guideline in high-risk patients receiving GA.

Kappen et al[37] offered a potential means of overcoming anesthesia providers' low involvement by presenting the patients' PONV risk score to them using a decision support tool. This increased the providers' administration of prophylactic antiemetics and resulted in a lower PONV incidence, particularly in high-risk patients.[37] The issue of the incorrect estimation and documentation of the Apfel risk score for PONV may be improved if the preadmission or preanesthesia testing office reviewed and recorded the risk score where it could be easily accessed by the anesthesia providers. We found a significant increase in providers' correct documentation of the Apfel risk score in the postimplementation period. Although this change was statistically significant, it did not clearly show that the providers applied the guideline to their preanesthetic preparation. Some providers may have modified their usual risk assessment without using the tool for PONV risk assessment. Many providers expressed their concern regarding uncertainty with estimation of the risk score. It would be beneficial to use a decision support tool and to present anesthesia providers with the patients' risk score as developed in the preanesthesia evaluation center to flag those as high risk. This would allow anesthesia providers' time to consider the need for prophylaxis. Jenkins et al[38] conducted a survey of 400 day-surgery patients to rank score avoidable postoperative symptoms. The absence of PONV was a major priority for patients. This initiative improved the providers' administration of prophylactic antiemetics and resulted in a lower incidence of PONV, particularly in high-risk patients. This has the potential to improve patient satisfaction and decrease unnecessary hospitalization and readmission for this patient population.[38,39]

Limitations

This project had several limitations. Manual chart review and data collection limited the number of patients included in the sample, thus the sample size was small. Numerous offerings of the staff education intervention would have benefited the department.

Conclusions

The introduction of a simplified PONV guideline for the management of PONV in female patients undergoing GYN and breast surgery resulted in a significant reduction in PONV incidence and also improved the anesthesia providers' compliance with the Apfel risk score documentation.

Anesthesia providers and perianesthesia nurses are well positioned to participate and lead efforts to assess and inform the surgical patients of their baseline PONV risk preoperatively. The use of a PONV guideline can help to improve both the patient experience and outcomes after ambulatory surgery. The use of PONV guidelines can help to improve both the patient experience and patient outcome after ambulatory surgery. These findings can also be translated into cost savings for the health system through a reduction in PACU length of stay secondary to postoperative PONV and resultant admission and readmission. The sustainability potential of this project depends on departmental support and continued education. The expansion of a PONV guideline to other populations is an important consideration. The implementation of the SAMBA PONV guidelines should be considered in all ambulatory surgery centers.

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