

Changing Anesthesiologists' Practice Patterns Can it Be Done?

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Background: Because the ultimate purpose of new medical knowledge is to achieve improved health outcomes, physicians need to possess and use this knowledge in their practice. The authors introduced enhanced education and individualized feedback to reduce postoperative nausea and vomiting (PONV). The primary objective was to increase anesthesiologists' use of preventive measures to reduce PONV, and the secondary objective was to determine whether patient outcomes were improved.

Methods: After obtaining hospital ethics committee approval, the effect of education and feedback on anesthesiologist performance and the rate of PONV in major surgery elective inpatients during a 2-yr period was assessed. After baseline data collection (6 months), anesthesiologists at the study hospital

received enhanced education (8 months) and individualized feedback (10 months). Parallel data collection was performed at a control hospital at which practice was continued as usual. The education promoted preventive measures (antiemetic premedication, nasogastric tubes, droperidol, metoclopramide). Individualized feedback provided the number of patients receiving promoted measures and the rate of PONV. The mean percentage of anesthesiologists' patients receiving at least one promoted measure and the rate of PONV were compared with baseline levels.

Results: At the study hospital, there was a significant increase in the mean percentage of the anesthesiologists' female patients receiving a preventive measure as well as a significant increase in the use of droperidol ≥ 1 mg ($P < 0.05$) for all patients. The use of other promoted measures was unaffected. Absolute rates of PONV were unaffected at the study hospital until the postfeedback period (decrease of 8.8% between baseline and postfeedback ($P = 0.015$)).

Conclusion: It was demonstrated that enhanced education and individualized feedback can change anesthesiologists' practice patterns. The actual benefit to patients from use of preventive measures was limited when used in the everyday clinical situation. Therefore, only modest decreases in PONV were achieved, despite the use of preventive measures. (Key words: Anesthesiology; academic detailing; physicians' practice patterns. Complications, postoperative: nausea; vomiting.)

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PHYSICIANS' practice patterns and how to change them has been the subject of considerable research. In part, this interest has developed from the current pressures of cost containment and resource allocation. Marked variations in practice patterns also have led to concerns about differences in the quality of patient care.¹ More fundamentally, if the ultimate objective of acquiring new medical knowledge is to achieve improved health outcomes, then we must understand how best to ensure that physicians are made aware of and use this knowledge in their practices.

In the past, the implicit expectation was that when physicians became aware of new information about clinical practice they would automatically change their practice patterns. However, research has revealed that changing physicians' behavior is more complex. A passive approach is essentially ineffective; it is insufficient

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merely to publish guidelines and expect changes—more active measures are needed to modify practice patterns.² Several interventions aimed at changing practice patterns have been tried with varying degrees of success, with “success” being defined either as a change in physicians’ behavior or, more satisfactorily, as improved patient outcomes resulting from the changed behavior. While various strategies have been suggested, it is now recognized that interventions combining more than one strategy (*e.g.*, education plus feedback) will yield better success rates than single methods.³

Postoperative nausea and vomiting (PONV) have been acknowledged as an extremely important issue to anesthesiologists and their patients. It is estimated that at least one third of patients will experience some degree of PONV after surgery—with younger, female patients at greatest risk.⁴ Current therapies are known to reduce the incidence of PONV, but are not always used in day-to-day clinical anesthesiology practice.

The primary objective of our study was to increase anesthesiologists’ use of specific preventive measures that have been shown to reduce the rate of PONV. The secondary objective was to determine the consequences for patient outcomes; that is, did changes in use of the promoted measures alter the rate of PONV? We also recorded the presence of adverse effects or additional benefits with use of the promoted measures.

Methods

To reduce the incidence of PONV in high-risk patients, we introduced active interventions (enhanced education plus individualized feedback) aimed at changing anesthesiologists’ practices. The goal of education and feedback was to increase the use of specific preventive measures. These measures were chosen based on two criteria. First, they had to be shown to be effective in reducing PONV in randomized controlled trials or from previous studies (nonrandomized) at the study hospital. Second, the promoted measures had to be inexpensive, readily available, and not overly complex in their application.

After receiving approval from the institutional ethics committee and signed participation forms from anesthesiologists, the directed interventions (enhanced education and individualized feedback) were introduced at one hospital. A second hospital served as a comparison; at this hospital, practice was conducted as usual and anesthesiologists received none of the directed in-

terventions. A parallel data collection was conducted at the two hospitals during three time periods: a 6-month baseline period (before the introduction of the directed interventions), an 8-month education period, and a 10-month feedback period. As well, data collection continued at the study hospital for an additional 6 months (postfeedback period) to determine whether the effect of the interventions at the study hospital would last past the active phase.

To choose the preventive measures to be promoted, first an extensive literature review on prevention of PONV was conducted by the investigators. This was followed by small group consultations with local experts, staff anesthesiologists, anesthesia residents, and nurses from the postanesthesia care unit (PACU). At the conclusion of these meetings, each participant was asked to rate the practicality and effectiveness of several proposed strategies. Specific strategies recommended to the entire group of anesthesiologists at the study hospital were chosen only after the consultative group reached consensus.

The five promoted preventive measures chosen for the study were: the use of antiemetic premedication (diphenhydramine, promethazine, perphenazine), nasogastric tubes, droperidol (Inapsine, Janssen Pharmaceutica, Mississauga, Ontario; ≥ 1 mg encouraged but <1 mg also promoted), and metoclopramide (Maxeran, Marion Merrell Dow (Canada), Laval, Quebec). The use of other drugs (*e.g.*, propofol) was recorded but not promoted. Owing to budgetary constraints, antiserotonin drugs were not available at either hospital. All other choices in anesthetic management were left to the discretion of each anesthesiologist. Drugs used to treat PONV after it occurred were not included in the tabulations because we considered the requirement for rescue medications to be a failure of preventive therapy.

Educational Interventions at the Study Hospital

The principles of academic detailing were used at the study hospital.⁵ This included the participation of a “local opinion leader” (individual identified as being knowledgeable and exerting leadership in clinical expertise), “educational influentials” (clinicians identified as having specialized expertise in the area), and enhanced education. Four 1-h educational seminars on PONV in which audience participation was encouraged, were given during the education phase. The educational seminars presented by the educational influentials outlined the pathophysiology of PONV, pa-

tients at highest risk, the pertinent etiologic factors, and the background rate of PONV in patients at the study hospital (to demonstrate that there was room for improvement in reducing the rate of PONV). The enhanced education also focused on specific preventive methods we had chosen to promote. After the educational seminars, written summaries of the main points were prepared and distributed to each anesthesiologist. As well, during the educational time period, key journal articles on the prevention of PONV were distributed in brightly colored binders to all staff. The key points in these articles were highlighted for easier reading.

Individualized Feedback at the Study Hospital

At the end of the educational phase, four individualized feedback forms (one every 3 months) were distributed confidentially to each anesthesiologist. The form (fig. 1) presented data both in a tabular and graphical format for ease of understanding and included the following features: the number of study patients he/she attended, the crude rate of PONV among his/her patients, the number/rate of preventive methods

used, and the adjusted rate of PONV among his/her patients. These frequencies were also displayed for the different time periods of the study as well as for the three anesthesiologists with the lowest rates of PONV. Using logistic regression modeling, the rates of PONV for each anesthesiologist's patients were adjusted for differences in patient age, gender, type of procedure, and use of postoperative opioids with the case-mix of the three anesthesiologists with the lowest rates of PONV as the reference group.

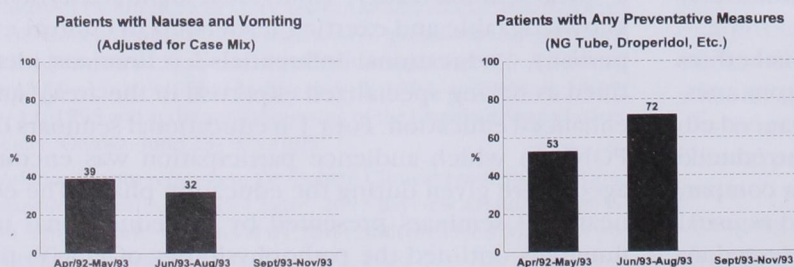
Study Patients and Data Collection (Both Hospitals)

The study focused on patients who were at high risk for PONV and who would be readily accessible for a postoperative interview. These were all inpatients receiving a general anesthetic undergoing a major elective operation (hernia repair, lower or upper abdominal procedure, major gynecologic procedure, major breast procedure, or major renal procedure). All patients were admitted to the PACU and discharged to a regular hospital ward for postoperative care.

POST-OP NAUSEA AND VOMITING: PERSONAL REPORT

Anesthesiologist: 163 (Personal data)	Apr/92-May/93	June/93-Aug/93	(The 3 Anesthesiologists with the lowest incidence. Their total data for the period June/93-Aug/93)
# of Patients Anesthetized	45	17	(52)
# of Patients with Nausea or Vomiting at any time	18	6	(13)
% With Nausea and Vomiting - Adjusted for Case Mix	39.0%	32%	(25%)
Preventive Therapy (% of patients prescribed)			
✓ Antiemetic Premed (diphenhydramine, perphenazine, promethazine)	13%	12%	(9.6%)
✓ Droperidol ≥ 1 mg in OR	16%	53%	(73.0%)
✓ Droperidol < 1 mg in OR	11%	0%	(13.5%)
✓ NG Tube in OR	16%	12%	(7.7%)
✓ Metoclopramide (Maxeran) in OR	4%	6%	(9.6%)

Fig. 1. Example of feedback report given to each anesthesiologist. The rate of postoperative nausea and vomiting (adjusted for case mix) and use of the five promoted preventive measures were noted both in tabular and graphic form for the different time periods (e.g., baseline and education combined vs. first 3 months of the feedback). Comparison data were the three anesthesiologists whose patients had the lowest rate of postoperative nausea and vomiting.



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Parallel data collection at the two hospitals was from three sources, anesthesia records, PACU records, and postoperative interviews. The anesthesia records at both hospitals had been redesigned in a checkoff format to facilitate data collection by anesthesiologists as previously described.⁶ The form allowed information to be collected on patient factors (*e.g.*, age, gender, physical status, current medical conditions, and medications used), the operation, the anesthetic technique used (*i.e.*, general or regional anesthesia), anesthetic premedication, intraoperative drugs and dosages, and monitors used. As well, the PACU records were also redesigned at the two hospitals so that both were using the same form. Data collection in the PACU was performed by PACU nurses and included duration of PACU stay (in h), medications and dosages used, and adverse events occurring in the PACU including nausea, vomiting, or both nausea and vomiting as well as treatments. Both anesthesiologists and PACU nursing staff had been extensively trained in the use of the forms prior to the study. Information on length of hospital stay was derived from a hospital database but was only available at the study hospital.

To assess the rate of PONV, study patients were interviewed the day after their operation by anesthesia research nurses. The postoperative PONV questionnaire was developed and tested at the study hospital before the beginning of the study. Research nurses received extensive training in its use at the hospital with pairs of nurses interviewing the same patients. Nonetheless, to ensure data compatibility across time and hospital, all research nurses rotated between the two hospitals. Nurses were not aware of the drugs administered to patients at the time of the interview.

The patient interview referred only to the first 6 h after PACU discharge. Patients were asked about the presence/absence of nausea, vomiting, a past history of nausea or vomiting after anesthesia, and other questions about their anesthesia care. If PONV was present, patients were asked to rate the severity on a 10-point visual analog scale.

The resources required to institute the interventions at the study hospital included the costs of the promoted measures, educational materials, and personnel (completion of postoperative interviews, data entry and analysis, and preparation of the feedback forms).

Statistical Analysis

Duplicate copies of all anesthesia and PACU forms were checked the next day by a designated anesthesia

research nurse and a clinical anesthesiologist for accuracy and completion. Data from the two forms and the postoperative interviews were subsequently entered into a customized dBase IV computer program and data were analyzed using the SAS statistical package (version 6.04, SAS Institute, Cary, NC).

For the primary objective, the anesthesiologist was the 'unit of analysis.' To determine if there was a significant change in the use of preventive measures over time controlling for hospital, a repeated-measures analysis of variance was used. Time period was considered the "within-subjects" factor and hospital was the "between-subjects" factor. We were interested in determining the interaction (if any) between hospital and time period because this would reflect the effect of our interventions on anesthesiologists' practices. Only anesthesiologists who were on staff at the hospital during the entire study were included in this analysis.

By hospital, during the three time periods among the study patients (baseline, education and feedback), we determined the percentage of each anesthesiologist's patients who received any preventive measure, the percentage of each anesthesiologist's patients receiving specific measures (*e.g.*, droperidol ≥ 1 mg), the percentage of anesthesiologists who used at least one preventive measure, and the percentage of anesthesiologists who used each preventive measure. The percentages were averaged by the number of anesthesiologists. With an unpaired *t* test, we compared the differences of the mean percentage of anesthesiologists' patients receiving a preventive measure between the baseline period and the educational and feedback periods at both hospitals and the postfeedback period at the study hospital. To identify any other changes in practice patterns, we also compared the rate of use of the five promoted preventive measures among study patients across the time periods of the study at both hospitals using the chi-squared statistic. Because the risk for PONV is very different for males and females, we analyzed the data separately by gender.

For the secondary objective, we used the patient as the unit of analysis. A power analysis performed before the beginning of the study indicated that a minimum of 400 patients per time period would be needed to detect an absolute reduction in PONV of 10% assuming a 50% baseline incidence ($\alpha = 0.05$, $\beta = 0.20$). Postoperative nausea and vomiting was defined as the presence of nausea or vomiting in the PACU or within 6 h on the ward. The crude rates of PONV were determined for study patients at the two hospitals during the base-

line, education and feedback periods for males and for females. As well, the rate of PONV was determined at the study hospital during the postfeedback period. We also examined the data to determine not only if the rate had changed but also to see if there was a shift in the PONV scores over time or changes during the PACU or on the ward. To rule out that changes in the rate of PONV might be due to changes in patient populations, we assessed the rate of PONV for differences in case-mix across the time periods. We used multiple logistic regression, which compared the rate of PONV at each period to that of the baseline time period as reference.^{7,8} The logistic regression model controlled for differences across time in age, history of smoking, type of operation, use of propofol, and use of opioids in the PACU or on the ward. A model was run separately for all patients, for males and for females at each hospital because we were interested in differences over time not differences between hospitals. A P value ≤ 0.05 was considered significant.

To ascertain if the preventive measures we had chosen to promote were actually efficacious in preventing PONV, we examined the relationship between their use and the rate of PONV after adjusting for covariates using logistic regression. As well, we examined possible side effects of the five promoted measures, specifically rates of postoperative wakefulness, sore throat, and the occurrence of unpleasant dreams or unusual sensations. Wakefulness scores were obtained from the postoperative interviews using a 10-point visual analog scale. Scores were compared using the Kruskal-Wallis test and the rate of problems with the chi-squared statistic ($P < 0.05$). Finally, we compared differences in the PACU length of stay and hospital length of stay for patients who were given preventive measures compared to those who were not with an unpaired t test ($P < 0.05$).

Results

During a 2-yr period, there were 3,328 patients who met the study criteria, 2,023 at the study hospital (1,621 females, 402 males) and 1,305 at the comparison hospital (899 females, 406 males). During the postfeedback period at the study hospital, an additional 392 female and 118 male patients were seen. An interview was obtained for 97.3% of the patients.

Overall, there were minor changes in case mix over time. For example, there were fewer gynecologic procedures at the study hospital and more intraabdominal operations during the second year of the study. Propofol

use for induction increased only at the study hospital. Otherwise, there were no changes of note over time regarding age distribution, physical status scores, number of smokers, or use of postoperative opioids at either hospital.

Figure 2 shows the mean percentage of anesthesiologists' patients who received at least one preventive measure over time. The hospital by period interaction (repeated-measures analysis of variance) was not significant ($P = 0.255$ for females and 0.809 for males). For the study hospital, there was a significant change in the proportion of each anesthesiologist's patients receiving any preventive measure from baseline to education and feedback among female but not for male patients. At the control hospital, there were no changes

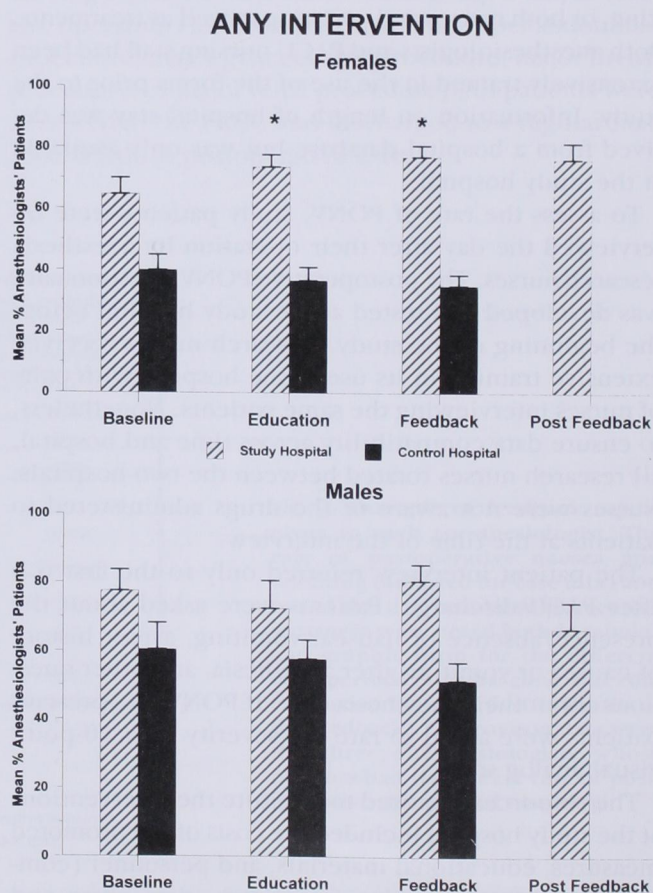


Fig. 2. Mean percentage (\pm SE) of anesthesiologists' patients who received at least one preventive measure at each time period (for female patients, there were 23 anesthesiologists at the study hospital and 24 anesthesiologists at the control hospital; for male patients, there were 16 anesthesiologists at the study hospital, and 21 at the control hospital). *Significantly different from baseline period, $P < 0.05$.

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noted between baseline, education, and feedback periods for either male or female patients. Other ways of analyzing the data (e.g., by the proportion of anesthesiologists using at least one preventive measure, or specific measures) gave the same results.

Examining each promoted measure separately, we found a significant increase in the percentage of anesthesiologists' cases receiving ≥ 1 mg droperidol (repeated-measures analysis of variance hospital by period interaction was significant at $P = 0.0001$ for females and $P = 0.0001$ for males) but not for the other measures. At the study hospital, for both male and female patients, there was a difference in droperidol use from baseline for all subsequent time periods (fig. 3). This change in the use of ≥ 1 mg droperidol for male patients also occurred between the education and feedback periods. There were no changes seen at the control hospital either for male or for female patients in the use of droperidol.

We next examined where the changes in practice had occurred over time by comparing the rate of use of the five promoted preventive measures among patients between baseline and feedback periods at the study hospital (table 1). The use of a small dose of droperidol (<1 mg) decreased from 40% of female patients and 25% of male patients during the baseline period to 8% and 4%, respectively, during the feedback period. Conversely, the use of a larger dose of droperidol increased from 16% of females and 11% of males to 60% of females and 52% of males. The use of nasogastric tubes and the use of antiemetic premedications were the same or actually decreased over the study. The use of metoclopramide increased with time, but occurred in less than 10% of patients. Overall, the rate of any preventive measure increased from 67% to 79% among female patients ($P < 0.05$). However, the change among male patients was minimal, from 75% to 77% (NS).

The crude rate of PONV at the two hospitals for male and female patients is seen in table 2. For all patients at the study hospital, there was a significant decrease in the rate of PONV between the baseline (47.0%) and postfeedback periods (38.2%; $P = 0.015$). At the control hospital, there was an absolute decrease in the rate of PONV of 5.2% between baseline and feedback periods (NS). For female patients at the study hospital, there was also a significant decrease in the rate of PONV between baseline and postfeedback periods ($P = 0.018$). The rate for male patients was not significantly changed at either study or control hospitals. Using a

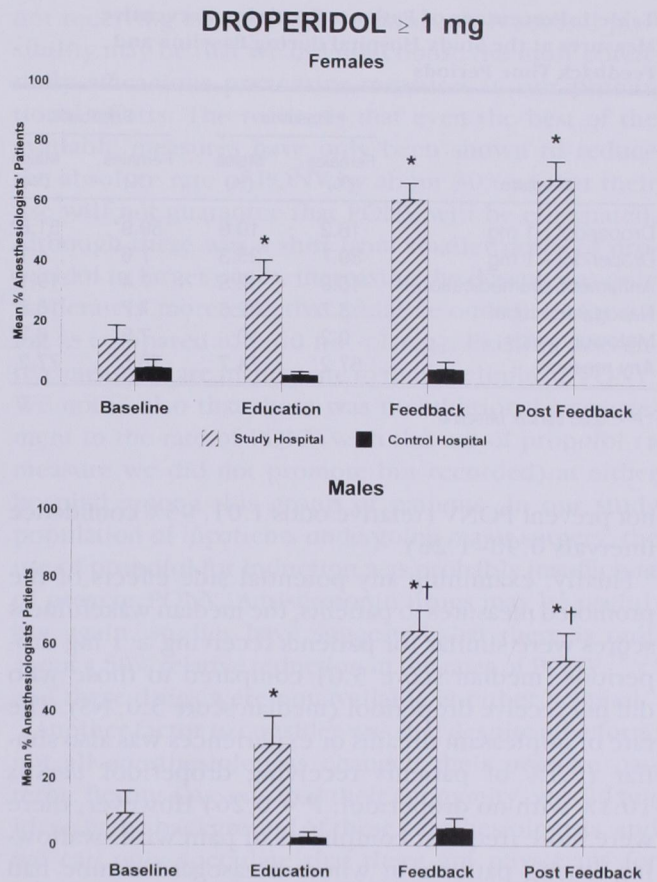


Fig. 3. Mean percentage (\pm SE) of anesthesiologists' patients who received droperidol ≥ 1 mg over time. *Significantly different from baseline, $P < 0.05$. †Significantly different from educational period, $P < 0.05$.

logistic regression to control for case-mix differences over time did not change these results. Reexamining the data in various ways (such as looking for shifts in the change in PONV scores, changes in the rate of PONV in the PACU or on the ward) did not alter our findings.

To determine if the preventive measures being promoted were effective, we used a logistic regression model to examine the relationship between use/nonuse of the promoted measures and PONV. We controlled for age, gender, history of smoking, type of procedure, use of propofol, and use of opioids during the postoperative study period (table 3). All of the promoted preventive measures were effective with significant relative odds of 0.47–0.63 compared to patients who did not receive any promoted measure. Propofol used for induction of anesthesia in 25.9% of patients was included as a variable in the logistic regression but did

Table 1. Percentage of Patients Receiving Preventive Measures at the Study Hospital during Baseline and Feedback Time Periods

Measure	Baseline		Feedback	
	Females (%)	Males (%)	Females (%)	Males (%)
Droperidol ≥ 1 mg	16.2	10.8	59.9*	51.8*
Droperidol < 1 mg	39.7	25.3	7.6*	4.1*
Antiemetic premedication	10.6	32.5	7.4	19.1*
Nasogastric tube	8.7	32.5	7.7	18.8*
Metoclopramide	0.2	0	7.9*	6.7*
Any measure	67.2	74.7	78.5*	77.2

* $P < 0.05$ versus baseline.

not prevent PONV (relative odds 1.01, 95% confidence intervals 0.90–1.26).

Finally, examining any potential side effects of the promoted measures to patients, the median wakefulness scores were similar for patients receiving ≥ 1 mg droperidol (median score 5.0) compared to those who did not receive droperidol (median score 5.0, NS). The rate of unpleasant dreams or experiences was also similar (7.1% of patients receiving droperidol versus 10.1% with no droperidol, $P = 0.26$). However, there were more frequent complaints of pain with swallowing among patients in whom a nasogastric tube had been inserted (47.8%) compared to those in whom a nasogastric tube had not been used (19.0%) ($P < 0.001$). Those who had received a promoted measure at the study hospital had PACU lengths of stay that were

significantly lower than for those patients not receiving a promoted measure (2.12 ± 0.7 h vs. 2.19 ± 0.8 h, $P < 0.05$). No differences were found in length of hospital stay.

Discussion

The primary objective of the study was to determine if anesthesiologists' practice patterns could be changed. Accordingly, anesthesiologists at the study hospital increased their use of one of the five promoted preventive measures. This use increased between baseline and education periods, was sustained during the feedback times, and was maintained during the postfeedback phase. As well, we were successful in highlighting high-risk groups in that the use of any preventive measure was increased among female patients. This illustrates that academic detailing and individualized feedback were effective in changing practice patterns, but only for some preventive measures and not others.

Why was the use of droperidol increased but not the other preventive measures? Anesthesiologists regularly use drug regimens to prevent or treat anesthetic adverse events, so it is not difficult for them to adopt a drug therapy if they are convinced that it is useful. The literature supports that droperidol is efficacious in reducing PONV.^{9–11} Also, droperidol was conveniently available in the larger dosage format.

However, there have been reports of increased postoperative confusion and sedation after droperidol ad-

Table 2. Crude Rate of PONV at Study and Control Hospitals over Time

Time Period		Study Hospital		Control Hospital	
		N	%	N	%
All patients	Baseline	564	47.0	360	49.1
	Education	658	42.7	419	46.1
	Feedback	801	40.0	526	43.9
	Postfeedback	510	38.2*	—	—
Females	Baseline	481	50.9	262	56.9
	Education	532	46.6	287	54.0
	Feedback	608	46.4	350	52.9
	Postfeedback	392	42.6†	—	—
Males	Baseline	83	24.1	98	28.6
	Education	126	26.2	132	28.8
	Feedback	193	19.7	176	26.1
	Postfeedback	118	23.7	—	—

Different from baseline (logistic regression); adjusted for gender, age, history of smoking, surgical procedure, induction agent, and postoperative opioid: * $P = 0.015$, † $P = 0.018$.

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Table 3. Relation between Preventive Measures and Risk of Postoperative Nausea and Vomiting

Preventive Measure	Crude Rate (%)	Adjusted Relative Odds* (95% CI)
Nil	53.7	1.0
Nasogastric tube	25.8	0.63 (0.49–0.81)
Droperidol ≥ 1 mg	38.0	0.47 (0.38–0.58)
Droperidol < 1 mg	45.9	0.60 (0.47–0.75)
Antiemetic premedication	32.0	0.47 (0.31–0.71)
Droperidol ≥ 1 mg + other measure	34.7	0.52 (0.36–0.74)

CI = confidence interval.

* Adjusted for gender, age, history of smoking, surgical procedure, induction agent, and postoperative opioid.

ministration,^{12,13} which may have deterred some anesthesiologists from its routine use. With regard to metoclopramide, some anesthesiologists may not have used it because of its extremely short duration of action, or because it was not deemed efficacious.^{11,14,15} Some may have hesitated because of concerns that, although free of sedating properties, rare neurologic problems have been reported.^{16,17} Nasogastric tubes, conversely, are not ordered primarily by anesthesiologists, but by surgeons and the latter may have been reluctant to use them in the postoperative period. Antiemetic premedications, we believe, were not more widely used, because hospital protocols did not allow for the easy administration of these medications to same day surgery patients; a protocol (or lack thereof) beyond the control of the anesthesiologist. Thus, it would appear that for changes in practice patterns to occur, strategies must be seen to be efficacious to practicing clinicians, should be familiar to them, and must be under primary control of the physicians themselves.

We also were able to demonstrate a modest benefit to patients in that the rate of PONV was reduced. However, the magnitude of this change was not as great as we had hoped. The absolute rate of nausea/vomiting for all patients at the study hospital was reduced 7.0% from baseline to feedback, but 40% of patients still had PONV. Only during the final phase, the postfeedback period, did the reduction in the incidence of PONV (8.8%) reach statistical significance. There are several other possible reasons why we did not make a bigger impact on PONV.

It was possible that the usage of preventive measures was already high, particularly for males, leaving little room for improvement. We do not think this was the case, because approximately 20% of patients were still

not receiving any preventive measure. A second possibility may be that we did not choose the most potentially efficacious preventive measures in our promotional efforts. The reality is that even the best of the available measures have only been shown to reduce the absolute rate of PONV by about 30% so that their use will not guarantee that PONV will be eliminated. Although there was a shift from smaller doses of droperidol to larger doses, increasing the dosage was only moderately more effective (relative odds 0.47 for ≥ 1 mg as compared to 0.60 for < 1 mg). Existing preventive measures are inadequate to totally eliminate PONV. We noted also that there was no additional improvement in the rate of PONV with the use of propofol (a measure we did not promote but recorded) at either hospital among this group of patients. In our study population of inpatients undergoing major surgery, the use of propofol for induction was probably insufficient to prevent PONV. Antiserotonin drugs may be useful, but again, studies have suggested that there is only about a 50% relative reduction in the rates of PONV,^{18–20} and these drugs were not available at either hospital.

Another factor to consider was that despite all efforts, not all anesthesiologists changed their practice patterns. Because we ensured their anonymity, we did not identify the background of these anesthesiologists, and we can only speculate that there are physicians for whom change is difficult. This may have been manifested when some of the anesthesiologists actively expressed a dislike of mandated or even suggested guidelines or protocols or considered that PONV was not an important problem.

To date, only a few studies have successfully applied the techniques of academic detailing. Use of audit, feedback, and opinion leaders were successful in increasing trials of labor and vaginal births after initial Caesarean section.²¹ A controlled trial conducted in six nursing homes used enhanced educational programs with interactive visits by clinical pharmacists to modify drug-prescribing patterns.²² Inappropriate drugs were discontinued and patient memory scores improved. Unlike our study of anesthesiologists at two hospitals, these studies were conducted at multiple sites, involving multiple disciplines, and different outcome measures were examined. Although several recent studies have attempted to alter anesthesiologists' practice patterns, most of these are related to reducing cost of drugs.^{23–25} None of these studies of anesthetic practice have attempted to examine the more complex task of improving patient outcomes.

In this study, we used the combined interventions of enhanced education and individualized feedback. There are other measures that we either did not or could not use. It was not possible (or desirable) for us to use financial incentives or disincentives. Given the mode of payment to anesthesiologists, there is limited scope for this sort of intervention. We also rejected the use of "advertising" materials such as posters that would have been visible to nonanesthesiologists. Other measures we did not consider as practical were the use of administrative interventions or strict protocols mandated by the hospital.³ Instead, in keeping with the concepts of "academic detailing," we wanted to promote activities using a positive message.

In contrast, one measure that we could have used to a greater extent was a greater participation by all associated health-care workers in the efforts to change. This effort could have been enhanced by a greater participation of pharmacists (preventive therapies conveniently available in prefilled syringes), PACU nurses (promotion of effective therapies), and surgeons (agreement to use nasogastric tubes postoperatively). Also, we might have included an increased number of anesthesiologists during the design phase of the study, the educational delivery, and feedback profile preparation. Some anesthesiologists found the feedback forms too complex and there appeared to be a reluctance to openly discuss issues around changing practices. More participation may have alleviated such concerns. If we were to begin again there are a number of things we would do differently such as involve anesthesiologists to a greater degree in the decisions on which preventive measures to promote and the involvement of others in the organization to facilitate changes beyond the control of the anesthesiologist.

In conclusion, we were able to demonstrate a change in practice patterns among anesthesiologists for the increased use of one antiemetic preventive measure. There also was a nominal benefit to patients; rates of PONV were reduced to a modest degree. Various measures to reduce PONV have been shown in randomized trials to be efficacious. However, this study illustrates that the actual benefit to patients from these measures was much less than expected when used in the everyday clinical situation.

The interventions used (*i.e.*, academic detailing with enhanced education and individualized feedback) were relatively inexpensive, easily produced, and could be readily adopted by other hospital-based clinicians. We conclude that changing physicians' practice patterns

is difficult but possible. However, more research is required around the behavioral aspects of physician and organizational decision making so that barriers can be identified and better directed interventions to change behavior can be realized.

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