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Improving Anesthesiologist Performance Through Profiling and Incentives

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Study Objective: *To determine the influence of profiling and incentives on anesthesiologist behavior in relation to several key indicators of performance.*
Design: *Prospective collection and analysis of operational data before and after implementation of a physician profiling, reporting, and incentive program.*
Setting: *University hospital.*
Measurements: *An intervention consisting of two components was studied with the intent of stimulating a high level of performance in relation to a peer group. The first component, a monthly report of physician performance via an individualized performance report, was provided to each physician for each of 6 months. The second component consisted of a financial incentive. For each month in the study, physicians were eligible to receive a variable financial incentive of between $0 and $500 per month depending on individual performance based scoring in relation to each other. Physician performance was tracked in five areas: 1) percentage of first cases of the day in the room at or before the scheduled in-room time, 2) percentage of cases with an anesthesia prep time less than a target, 3) percentage of cases delayed due to waiting for an anesthesiology patient evaluation, 4) percentage of cases delayed during the anesthesiology controlled time, and, 5) percentage of cases delayed due to waiting for the anesthesiology attending. Results were reported to each physician on a monthly basis, by e-mail distribution, of an individualized perioperative efficiency summary report. A monthly financial incentive was awarded to the top performing physicians in the form of a credit to the physician's personal CME/expense account. Also, all physicians received a rank order list of their performance on each indicator at the end of each month.*
Main Results: *31 anesthesiologists, comprising the multispecialty division, and covering all services with the exception of obstetrics, pediatrics, and cardiothoracic anesthesia were tracked for 6 months. Compared to the first month, the percent of first cases of the day in the room at or before the scheduled start time and the percent of cases with an anesthesiology prep time less than target increased significantly (19 ± 4.6%,* vs. *61 ± 6.5%, 95% CI,* $p < 0.001$*; and 57 ± 5.3%,* vs. *73 ± 5.1%, 95% CI,* $p < 0.001$*) during the sixth month. The mean number of cases per physician with a delay during anesthesiology controlled time decreased (14.9 ± 2.9* vs. *3.3 ± 1,* $p < 0.001$*), no change occurred in the number of cases with a delay due to waiting for an anesthesiology patient evaluation or number of cases delayed due to waiting for the anesthesiology attending in the sixth month compared with the first month.*
Conclusion: *Tracking and rewarding physician performance with monthly profiling and a financial incentive given to the best in a peer group improves anesthesiologist performance in several key areas.*

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Table 1. Efficiency Indicators Tracked During Study Period

Indicator	Target	*Definition*
% of first cases of the day in the room on time	> 90%	First case of the day for each OR, patient in the OR at or before scheduled start time.
Anesthesia prep time < 15 minutes	> 90%	Time from patient in room to anesthesia team turnover to surgical team for positioning and preparation for surgery
% of cases delayed due to waiting for an anesthesiology patient evaluation	<10%	Circulator nurse judgment that case progress was delayed by the need to wait for completion of an anesthesiology patient evaluation that could have been completed in a manner not to delay the OR
% of cases delayed during anesthesiology controlled time	<5%	Circulator nurse judgment that case progress was delayed by inappropriately excessive anesthesiology procedure, induction, or emergence time
% of cases delayed due to waiting for the anesthesiology attending	<5%	Circulator nurse judgment that case progress was delayed by inappropriate waiting for the presence of the anesthesiology attending

Keywords: Anesthesiologists; manpower; efficiency; incentive program.

Introduction

In most health care institutions, the operating room (OR) represents the largest source of both hospital revenue and costs.[1] Operating room utilization and efficiency have been extensively studied.[2,3] Investigations have demonstrated the use of patient scheduling to maximize OR block time utilization,[4] staff scheduling to minimize labor costs,[5] materials systems analysis to decrease supply costs,[6,7] and individualized anesthetic techniques to speed patient throughput. [8,9]

The process of patient care is dependent on the coordinated efforts of a large number of care providers. It has been shown that surgeons, even within a single specialty, exhibit a wide variation in profitability depending on their practice patterns.[10] Other providers may present significant variation in the motivation and ability to deliver efficient medical care, which may account for a significant portion of the wide range of profitability exhibited by health care institutions. Maximizing the productivity of individuals on the day of surgery is critical to perioperative process improvement and the goal of maximizing profit in the operating suite.

Overdyk et al.[11] identified several indicators, such as first case of the day in-room time, anesthesia preparatory time, and anesthesiologist availability delays that are controllable by individual anesthesiolgists. Vitez and Macario[12] have shown that identifying and setting performance standards can improve timely first-case starts and turnaround times. However, providing a financial reward and a peer group comparison to an individual anesthesiologist to incentivize performance improvement in this setting has not been studied to date. We hypothesized that providing both publicly posted, comparative timeliness-related performance data and a financial incentive to reward anesthesiologist efficiency would lead to performance improvement in the OR as measured by several key indicators.

Materials and Methods

With Vanderbilt University Medical Center Institutional Review Board approval for the study, we collected performance data for 31 anesthesiologists providing care for 6618 surgical cases completed at Vanderbilt University Hospital, an academic tertiary-care hospital located in Nashville, Tennessee, between September 1, 2002 and February 28, 2003. The data of six anesthesiologists were excluded from analysis because these physicians were not present in the study group during both the first and sixth months. Data were collected for cases representing all services with the exception of pediatrics, cardiothoracics, and obstetrics. These services were not included in our study to minimize the possible effects of variability in case mix because each of these services provides treatments that are not directly comparable to a general OR suite. Data were collected using the Vanderbilt Perioperative Information Management System (VPIMS™), an integrated patient tracking, nursing documentation, and electronic anesthesiology record-keeping system. Data points collected included in-room time, anesthesiology ready time, surgical case completion time, and out-of-room time. In the case of a room exit delay due to a lack of post-anesthesia care unit (PACU) space, the time that the OR was placed on hold for the PACU was considered out-of-room time. Recording of time points was a shared duty of the anesthesia team and nursing team, with agreement to times occurring as the times were entered. Additionally, nurses recorded subjective delay data by recording an anesthesiologist-related delay for any delays arising from the need to perform an anesthesiology evaluation, delays due to excessive induction or emergence time, or delays due to an attending anesthesiologist being unavailable (*Table 1*).

Data were collected in two phases. Phase 1: Baseline performance profiling. The program and baseline performance data were presented to physicians after the first month of data collection. Data reporting was done in the form of an integrated physician monthly report graphically showing these indicators (*Appendix 1*). Phase 2: Financial incentive and monthly reports. Beginning in the

Table 2. Demographic Data of Study Population

	Month 1	Month 6	*p*
N total cases (first cases)	1261 (387)	1439 (412)	
Mean age, yrs ± SD	48 ± 17, n = 1038	48 ± 18, n = 1188	0.18
% Inpatient	82	83	
% ASA Class 1 or 2	55	54	
ASA Class 3 or >	44	46	
Mean Case length (min ± SD)	167 ± 111, n = 1251	154 ± 105, n = 1433	0.02

second month, a monthly incentive based on performance was initiated at the rate of $100 for each of the top 20% of physicians in each of the five categories, and that was contributed to a CME/expense fund. This amount was determined through a poll of several physician leaders in the Department of Anesthesiology and chosen both as an amount that would provide a small yet visible reward to performance improvement yet not be so large as to encourage unsafe practice. Physicians scoring a tie in any category were each awarded one half of the award for that category. Further stimulus was provided by reporting the rank of each physician in each category and the total monthly incentive amount received (maximum $500 if within the top 20% of all categories) by each physician. Anesthesiologist performance on the time indicators, and delay indicators was compared between the first and six months of the program and analyzed using a Fisher's exact test and Student's *t*-test (SPSS, v10.1.0, SPSS, Chicago, IL), respectively.

Results

A total of 31 anesthesiologists were tracked during the study period. Full-time equivalency ranged from one to five clinical OR days per week (20% to 100%). A total of 1261 cases were recorded in the initial period, and 1439 cases were recorded after the intervention. Mean age, inpatient percent, and ASA group did not vary between groups, whereas mean case time was significantly longer in the post-interventional group (*Table 2*).

Figure 1 shows that the percentage of first cases of the day meeting the goal of being in the OR at or before their scheduled start time was significantly higher during the sixth month of the study (19 ± 15% *vs.* 61 ± 19%, $p < 0.01$), and that the percentage of cases meeting the goal of an anesthesia preparation time of less than 15 minutes increased over the study period (57 ± 18 *vs.* 73 ± 14, $p < 0.01$).

Figure 2 shows that subjectively recorded delays due to waiting for preoperative patient evaluation and delays from waiting for an anesthesia attending were not significantly changed, whereas delays from lengthy anesthesia preparation or emergence time were decreased (14 ± 9 *vs.* 3 ± 3, $p < 0.01$) during the study period.

The reporting and incentive program was well received by the physicians. There were no issues of staff retention or divisional transfers related to the study during the study period. Most enjoyed the competition that resulted in improved scores in the ranking. There were a few isolated complaints from some physicians who tended toward the more complex cases, such as vascular and neurosurgical. However, we noted that with the exception of the anesthesia ready time of less than 15 minutes, none of the other indicators was tied to case complexity. *Figure 3* shows the distribution of total award dollars over the study period. All physicians received an award during the study, with the majority receiving monthly winning scores in one or two categories, correlating to an incentive payment of $100 to $200. The mean award to each physician did not change significantly over the study period ($104 to $119, $p = 0.25$). This finding was not unexpected, because the physicians were scored on relative performance to each other and not performance relative to the goal. As overall group performance increased, so did the performance level necessary to achieve an award.

Discussion

The most significant performance improvement occurred in the category of first cases of the day entering the OR at or before their scheduled start time, with a 42% increase

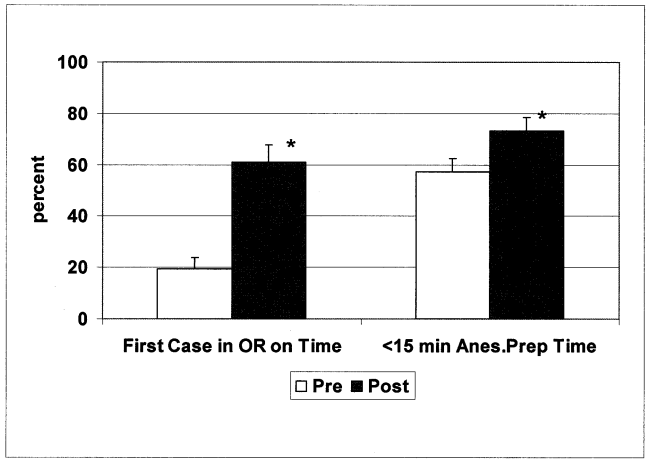

Figure 1. Percentage of cases meeting target (± 95% CI, $*p < 0.05$). During the sixth month of the study, the percent of first cases of the day entering the OR on time increased significantly compared with the first month of the study. Additionally, the percent of cases with an anesthesiology preparatory time, defined as in room to beginning of surgical positioning or prep, of less than 15 minutes increased significantly.

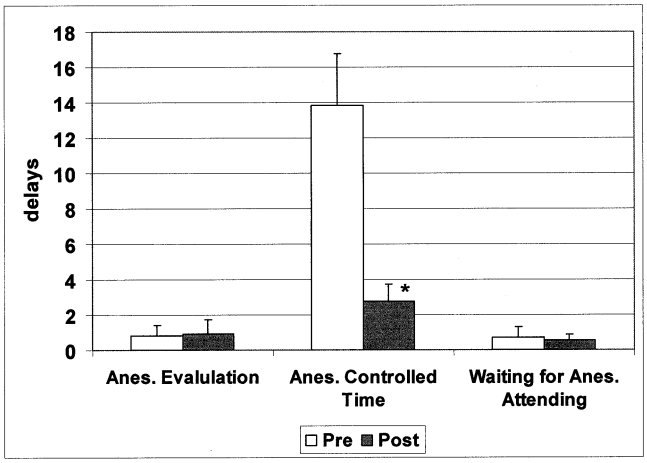

Figure 2. Mean number of delays per anesthesiologist per month (± 95% CI, $*p < 0.05$). The mean number of anesthesiology controlled time delays, defined as a subjective delay recorded by OR nursing staff during the anesthesiology induction or emergence period decreased significantly in the sixth month of the study compared with the first month. The mean number of delays recorded due to the need to perform an anesthesiology evaluation or waiting for an anesthesiology attending for either induction or emergence did not change during the time period studied.

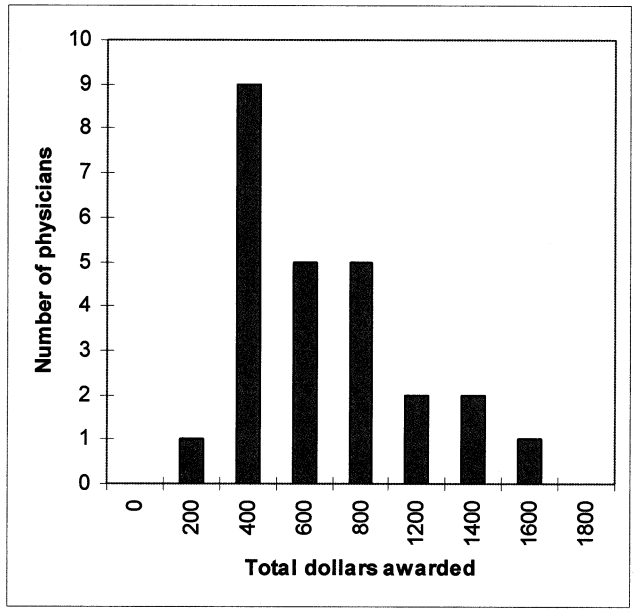

Figure 3. Total CME dollars awarded per anesthesiologist, reported in $200 increments, over the 6-month study period. Incentive awards were based on anesthesiologists receiving $100 for each score in the top 20% of the group for each of the five indicators studied. In the event of a tie on any indicator, the award was split among the equally ranked anesthesiologists. Participation in the incentive was universal. Although some physicians received no awards during some months, all received an incentive at some point during the program.

over the study period. These results compare similarly to results reported in 1998 by Vitez and Macario,[12] in which institution of performance standards was found to decrease anesthesiology-related delays to timely first-case starts from 36% to 9%. However, our study included not just anesthesiology-related delays, but all causes of delay for first-case starts. In this analysis, the anesthesiologist would not receive credit for being on time if any other team member failed to be ready at the appointed time. This scenario included such items as incomplete surgical permits and OR nursing not ready to accept the patient into the OR. This arrangement was made to "incentivize" the anesthesiologist to be the team leader and encourage other disciplines to contribute to the timely first-case starts. Additionally, our study adds individualized anesthesiologist reporting and financial incentives, and provides awards for performance not judged against a preset standard, but for superior performance within the group. As performance improved during the study period, the level necessary to achieve an award also increased.

Although the increase in on-time first-case starts and the effect it had on OR staff morale was tangible, the actual time saved may be less significant than it appears because it may represent many cases that previously had entered the OR only a few minutes late that because of our intervention were now in the room on time. There was no credit given for cases that entered the OR as little as 1 minute after the designated room start time (7:00, 7:30, or 8:00 depending on service and day of week). A post-hoc analysis was done to examine the number of first-case delays of at least 30 minutes and 60 minutes. It was found that 30-minute delays decreased from 20% in month 1 to 7% in month 6. At 60 minutes, delays decreased from 3% to 2%. Dexter *et al.*[13] demonstrated that the time saved is not financially relevant until it is lengthy enough to allow for an additional case to be done in the OR. However, as with turnover time, cases starting on time is a highly visible statement of OR efficiency. In fact, total recorded delays due to all reasons during the two periods decreased from 960 (n = 1261, 76%) to 880 (n = 1439, 61%).

One of the potential pitfalls of incentive-based programs in health care is that it is rare for a single class of providers to be primarily responsible for a particular efficiency outcome. In our experience, improvement required recruiting the multiple teams participating in patient preparation. Surgical teams were requested to have their paperwork complete, and nursing teams were requested to have instrument set ups complete 10 minutes prior to scheduled start time. Although anesthesiologists were not primarily responsible for these tasks, it is conceivable that they can influence the behavior of other team members in the completion of these tasks. Specifically, delays as a result of surgical history and physical and operative permit completion decreased from 166 (n = 1261, 13%) to 139 (n = 1439, 9%).

In calculating appropriate anesthesiology controlled time, 15 minutes was arbitrarily chosen as a length of time

for transfer of the patient to and from the stretcher, application of standard monitors, and induction of anesthesia. Positioning and surgical preparation time prior to incision was not included. Compensatory time for invasive monitoring, regional anesthesia, or planned difficult airway instrumentation was not allowed. It is assumed that the cases requiring invasive techniques were evenly distributed among the anesthesiologists, who generally share duty across the services. It is also noted that there is also some degree of specialization among a few anesthesiologists in the group; for example, vascular or ambulatory cases, and that this tendency toward one type of patient may place an individual anesthesiologist at a competitive advantage or disadvantage compared with others in the group, for the purposes of this measurement. Over the study period, there was a 16% increase in cases with an anesthesia prep time of 15 minutes or less. As with first-case starts, the leadership role of the anesthesiologist in moving cases forward is noted in achieving this goal.

Recording subjective delays requires significant education of staff to reach agreement on what constituted a delay. Unlike the time-based indicators, recording the subjective delays required the active intervention of the OR circulator nurse to enter into the record the delay and the reason for the delay. This action may have resulted in underreporting of delays. However, there should not have been any more or less underreporting during the sixth month of the study compared with the first. To maximize correct reporting, staff were trained to identify practices that significantly varied from an ideal practice as a delay. For example, a patient who was delayed on entry into the OR because of the need to complete an anesthesiology evaluation, despite being present in the holding room for a significant period of time prior to the case, would constitute a delay. On the other hand, a patient who arrived late to the hospital and who received a prompt evaluation on arrival to the holding room, would not constitute a delay even if the OR were ready and waiting for the patient. Similarly, delays were recorded for anesthesiology controlled time and time spent waiting for an anesthesiology attending. There were no changes noted in delays due to anesthesiology evaluation and delays waiting for an anesthesiology attending. It is noted that these delays at baseline were already minimal, suggesting that they were are not ideal measures for a performance improvement initiative. However, this finding was unknown going into the study. Given that these items are often cited by surgical and nursing staff as causes of delay of the OR schedule, it is both important and interesting to note their relative lack of significance to delaying the progress of the OR during our study.

Anesthesiology-controlled time delays (induction delays and emergence delays) decreased by an average of 11 per anesthesiologist per month. This finding reflects the focus the incentive placed on the need for timely induction and emergence of anesthesia. Unlike the earlier measure, percentage of cases with a preparation time of 15 minutes or less, it was noted that this measure of delays during anesthesia-controlled time was not subject to a specific time limit. Therefore, the disadvantage that larger, more complex cases represented toward achieving the goal of a shorter than 15 minute prep time did not apply to this indicator. Likewise, those physicians of the group who focused on ambulatory patients were not at a competitive advantage due to a relatively higher percentage of less complex cases.

Over the study period, we were able to track improvements in anesthesiologist performance by providing written feedback and a financial incentive. Although there was improvement in these three indicators, none reached an ideal state of 100% of goals met or zero delays. This is partially due to the multiple factors that are noted to be out of the control of the anesthesiologist, such as missing surgical instruments, factors affecting nursing teams, complete surgical preoperative documentation, and late-arriving patients. Moreover, it is recognized that not every anesthesiologist can be present at exactly the right time and place 100% of the time. Providing performance information and incentives to anesthesiologists can improve performance in regard to first case on-time starts, reducing anesthesiology preparation time, and reducing delays related to anesthesiology preparation and anesthesiology emergence time. The ability to sustain or improve this performance, and the impact of this improvement on other aspects of perioperative patient care, requires further investigation.

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Appendix 1. Individualized monthly report of performance provided by email to the anesthesiologists. An automated system was used to generate a monthly performance report for each anesthesiologist during the study period. This monthly report was distributed to the physicians by email at the time of the announcement of the financial award and award ranking. The first page of the report is shown here (name removed) as an example of the information distributed to the physicians. Additional pages contained information such as case mix, ASA physical status, delay details, and patient satisfaction scores.