Improving operating room efficiency through process redesign

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Background. *Operating rooms (ORs) are important resources for patient care and revenue, yet a significant portion of OR time is taken up by nonoperative activities. We hypothesized that redesigning the process that occurs between operations would lead to a decrease in nonoperative time (NOT = room turnover time plus anesthesia induction and emergence time).*
Methods. *Following a 3-month multidisciplinary planning process, a prospective study to reduce NOT was initiated in 2 of 17 ORs at a tertiary care academic medical center. Unlike previous reports, which have limited the number of participants, we constructed a process that was restricted only by case duration. The plan focused on minimizing nonoperative tasks in the OR, effecting parallel performance of activities, and reducing nonclinical disruptions. Eligible cases were those with an estimated operative time of 2 hours or less. A target NOT of 35 minutes was established. Cases of similar duration in the remaining ORs served as a concurrent control group.*
Results. *Twenty-three surgeons, 13 anesthesiologists, and 11 nurses worked in the project ORs over a 3-month period. Residents participated in all cases. There was a significant reduction in NOT (42.2 ± 12.9 vs 65 ± 21.7 minutes), turnover time (26.4 ± 11.2 vs 42.8 ± 21.7 minutes), and anesthesia-related time (16.9 vs 21.9 minutes, all* $P < .001$*) in the project rooms compared with cases of similar duration in control ORs. Process-related delays were identified in 70% of cases when NOT exceeded the 35-minute target.*
Conclusions. *These results demonstrate that a coordinated multidisciplinary process redesign can significantly reduce NOT. This process is applicable to most ORs and has optimal benefit for cases of 2 hours or less in duration. The high percentage of residual process–related delays suggests that further improvements can be anticipated. (Surgery 2006;140:509-16.)*

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Inefficiencies in an operating room (OR) can occur during and between cases and lead to multiple problems including delays in the delivery of patient care. They also have a negative financial impact for the institution and cause frustration for surgeons, anesthesiologists, and other OR staff. Ultimately, delays are associated with dissatisfaction among patients as well as heath care providers. Many hospitals are affected by this problem and expend their resources to find opportunities to improve efficiency.

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Turnover time (TOT) encompasses the time to clean and ready an OR for the next case. Several previous studies have focused on reducing TOT.[1,2] Others have approached this problem by addressing nonoperative time (NOT), defined as the time from when surgical activity ends until the time that the next patient is ready for the skin prep.[3-5] NOT includes TOT and represents a broader measure of time during which no operative activity takes place. There are additional opportunities to increase overall OR efficiency by using NOT to assess the effective use of time since it is more comprehensive in scope.

Reductions in NOT are best achieved by working faster, not harder.[6] Approaches to gaining efficiencies in NOT have included the incorporation of new or improved technology, modification of traditional OR design, adding personnel, and improving work flow through the use of parallel processing. Each of these approaches has challenges and sometimes costs associated with their use. In contrast to

others who have addressed OR efficiency,[3-5] we placed ourselves under two constraints: (1) The new process would not require additional staff, and (2) all surgeons whose block times included a preponderance of cases with operative times of 2 hours or less who would commit to following the new process would be included.

Our impetus to organize a structured approach to the redesign of NOT was precipitated by moving to a new operating suite. We hypothesized that redesigning the process that takes place between operations would decrease NOT. Despite these self-imposed constraints, we achieved NOT comparable to other recent reports.[1-5]

METHODS

MetroHealth Medical Center is a county-owned, tertiary care, academic medical center that recently built a new operating suite with 20 ORs and state-of-the-art equipment. During a 3-month preparatory phase, a multidisciplinary team met regularly to analyze the existing perioperative flow with a focus on decreasing NOT. This team included anesthesiologists, surgeons, perioperative nurses, and representatives from ancillary services including presurgical evaluation, housekeeping, central supply, information systems, administration, an industry representative (TRUMPF Medical Systems, Charleston, SC), and consultants on operational improvements (Twin Peaks Group, LLC, Boston, Mass). The project team was charged with designing a new process to reduce NOT, which traditionally exceeded 60 minutes. This group examined the current patient flow beginning in the surgeon's office when an operation was deemed necessary through discharge from the OR suite. Detailed charts of patient flow along with the specific tasks performed by each member of the perioperative team were constructed.

The project team developed and tested a number of preoperative process improvements that were incorporated into the flow design (Table I). These improvements included mandatory signing of informed consent in the surgeon's office rather than on the day of surgery, mandatory presurgical evaluation by the Department of Anesthesia within the week before the operation was scheduled, and exporting patient data to the OR suite through information technology. OR rooms were equipped with mobile exchangeable operating table tops (TRUMPF Medical Systems). This system allows patients to be placed on the OR table top in the preoperative area and eliminates the need to physically transfer a patient to and from the OR table. A single patient monitoring system (Philips Medical Systems, N.A., Bothell, Wash) was used, which allowed monitoring leads to be placed on the patient in the holding area before transport into the OR; these same leads were maintained until the patient was discharged from the OR suite.

Table I. Examples of process redesign

Tasks transferred out of the operating room
1. Patient placed on mobile table top in holding area
2. Preoperative nurse interview obviates the need for circulating nurse interview
3. Monitoring leads placed on patient in the holding area
4. Patient taken to the postanesthetic care unit on mobile table top
Parallel processing
1. Anesthesia interviews next patient and obtains medications during ongoing case
2. Environmental services personnel begins room cleanup as dressing is placed
3. Anesthesia personnel splits duties: one takes the current patient to the postanesthetic care unit, while the other prepares the room for next patient
4. Circulating nurse and scrub open instruments and prepare room during cleanup
5. Case carts brought to substerile area before room cleanup
Minimization of nonclinical disruptions
1. Operative permits are scanned in surgeons' offices
2. Mandatory presurgical evaluation instituted
3. All patient information (including operative permits) available on the hospital information system

The team also addressed nonclinical disruptions. For example, there often was a delay in the arrival of environmental services for room cleaning. To minimize this delay, pagers were given to these workers, and they were alerted 5 minutes before the end of surgical activity.

To ensure multiple measurements of NOT in each room daily, we focused this process improvement project on ORs with several cases predicted to be 2 hours or less in duration. Data and patient information were obtained from a proprietary surgical information system (Surgical Information Systems, Alpharetta, Ga) and an internally designed tracking form completed by the circulating nurse. Data for NOT were obtained from the surgical information system, while data on the causes for delay were obtained from the tracking form.

Standard definitions were used according to the American Association of Clinical Directors (AACD) Procedural Times Glossary (http://aacdhq.org/glossary.htm, Table II). Nonoperative time was de-

Table II. Standard definitions for procedural times

Operative time (OT)	Time from when the patient was ready for the surgical prep to the end of surgery
Turnover time (TOT)	Time from departure of previous patient from OR to entrance of next patient into OR
Room ready (RR)	Time when the room is cleaned and the supplies and equipment necessary for the beginning of the next care are present
Anesthesia induction	Time when the anesthesiologist begins the administration of agent to provide the level of anesthesia required for the scheduled procedure

Definitions available at http://aacdhq.org/glossary.htm.
OR, Operating room.

fined as the time from when one operation ends until the next patient is ready for surgical prep. Anesthesia induction time (AIT) was defined as the time interval from when the patient entered the OR until the release for skin prep. Anesthesia emergence time (AET) was defined as the time from the end of operative activity until the patient left the room. Although AIT and AET are not standard definitions accepted by the AACD, they represent important components of NOT.[3,4] A target of 35 minutes was established for NOT.

Data were collected prospectively and reviewed weekly. Means and SDs were calculated (Table III) and statistical analysis was done with the use of the Student *t* test. A *P* value of $< .05$ was considered significant. Cases of 2 hours or less in duration done concurrently in the remaining ORs served as a control group.

RESULTS

A 2-week-long pilot project was initiated to introduce and test the new process. After revisions were made, the process was introduced into 2 ORs sequentially. During the early weeks of the new process, members of the project team periodically monitored the rooms to ensure that the participants complied with the new process. Apart from this temporary change in support, staffing levels in the perioperative area was unchanged during the project.

Two hundred thirty-nine cases were included in the 2 project rooms over a 3-month period. There were 23 surgeons, 13 anesthesiologists, and 11 nurses who participated in the project. Surgical and anesthesiology residents participated in all cases. Figure 1 demonstrates the process redesign and the emphasis on parallel workflow.

Eighty-three percent of the cases in the project rooms were 2 hours or less in duration. The NOT and each of its component times (TOT, AIT, AET) were reduced in the project rooms compared with operations of similar duration performed in control rooms (Table III [$P < .001$]). The NOT was reduced by 37%, TOT by 38%, AIT by 27%, and AET by 18%. The median NOT was 42 minutes. The target NOT of less than 35 minutes was achieved in only 27% of cases.

Figure 2 compares the weekly average NOT and the room-ready time for the 2 project rooms. Room-ready time is a particularly valuable benchmark because it is not affected by most causes of excessive delay. If the scrub nurse had promptly alerted the anesthetist to move the next patient into the room when the room is ready, we would expect NOT to be approximately 17 minutes longer than the room-ready time or about 30 minutes. This expectation suggests that our NOT target was realistic.

Table IV summarizes the causes for delay when NOT exceeded 35 minutes. One hundred seventy delays were identified. The most commonly recorded reasons for delay were due to the patient's clinical condition and the availability of instruments. The "no consent" category accounted for 8% of the delays. Process-related delays were identified in 70% of cases that exceeded the NOT target.

DISCUSSION

These results demonstrate that a coordinated multidisciplinary process redesign emphasizing the use of parallel process improvements can significantly reduce NOT. During NOT, a series of tasks is performed. Some but not all of these tasks must be performed sequentially. We planned the new process to optimize the number of tasks that could be performed in parallel. Examples of parallel performance of work included initiation of OR cleaning before the patient leaving the room and visitation of the patient by the anesthesiologist in the holding area during the preceding case when possible. Communication between all OR personnel was improved by the use of mobile phones, which enhanced their ability to move in parallel and helped minimize delays. The redesigned process relies heavily on each member of the team performing his or her tasks in a synchronized manner.

It was important to examine the entire perioperative process beginning with information collection and instructions provided in the surgeon's office, and culminating with the patient's arrival in

Table III. Nonoperative time, turnover time, and anesthesia induction and emergence times (all values are in minutes)

	Project rooms (all cases)			*Control rooms (cases ≤ 2 h)*		
Parameter measured	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*
Nonoperative time	42.2*	12.9	239	65.3	21.7	944
Turnover time	26.4*	11.2	239	42.8	21.7	944
Anesthesia induction time	8.5*	4.3	379	11.7	6.2	1994
Anesthesia emergence time	8.4*	5.8	375	10.2	7.4	1204

*$P < .001$.

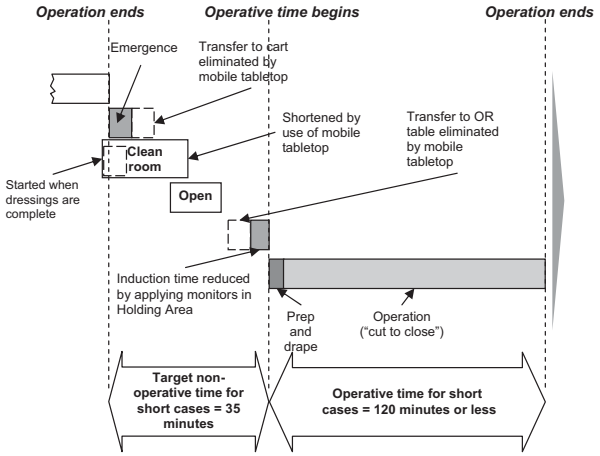

Fig 1. Redesigned process using parallel processing.

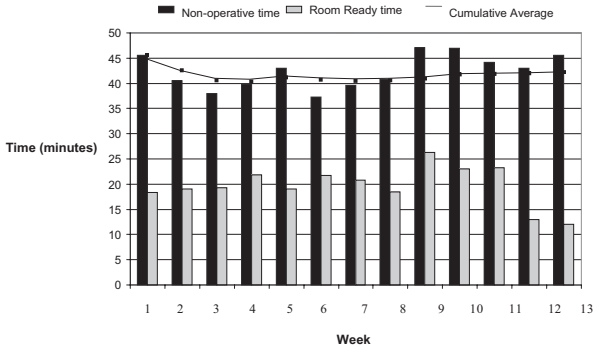

Fig 2. Weekly average nonoperative time and room-ready time.

the postanesthetic care unit. The project team consisted of representatives from multiple disciplines involved in the perioperative process. These representatives included not only traditional personnel such as anesthesiologists, surgeons, and OR personnel, but also representatives from services that provided essential support to the perioperative process. Each of these individuals brought expertise from different areas of the institution and made significant contributions to the project.

Table IV. Reasons for delay when nonoperative time exceeded 35 minutes

Cause for delay	*Frequency (%)*
Clinical (difficult IV, difficult intubation, change in patient condition)	16
Instruments or supplies unavailable	10
No operative consent	8
Laboratory result unavailable	8
Patient late in arriving	8
Process not followed	8
Technology-related delay	7
Environmental services delayed	6
Anesthesiologist delayed	6
Surgeon delayed	6
Other	17

A variety of methods have been employed to reduce NOT. They include the use of new technology, facility construction, addition of personnel, and process redesign. The 2 methods that we used to reduce NOT were process redesign and improvements in technology. We incorporated 3 key elements into process redesign: (1) elimination or moving of nonsurgical tasks out of the OR; (2) performance of activities in parallel whenever feasible and safe, and (3) minimization of nonclinical disruptions. We were able to reduce NOT and its components by addressing each of these areas. A few deserve to be highlighted.

Unavailable operative permits had been a major cause for delay in starting cases. Operative permits were scanned in the surgeons' offices and information exported to the OR suite in a patient information system, which markedly reduced missing permits as a reason for delayed operations. Presurgical clinical evaluation became mandatory rather than optional. Clinical nurse practitioners and anesthesiology residents evaluated patients to opti-

mize the efficiency of anesthesiologists. This lead to decreased cancellations on the day of operation and helped minimize a number of nonclinical disruptions. Placing monitoring leads on the patient, beginning intravenous lines, and initiating medications in the preoperative holding area were tasks that were moved outside of the OR. The reduction in AIT and EAT reflects the time saved by these improvements in process design.

Deploying new technologies or reconfiguring existing technologies is one method to decrease NOT. The use of mobile exchangeable OR table tops eliminated the need to transfer a patient from a gurney to the OR table both before and after an operation. While we did not quantify the number of minutes saved that were directly attributable to this task, we estimated that it reduced NOT by 7 to 8 minutes.

Facility-based interventions such as the use of induction rooms, which allows anesthetics to be administered before arrival in the OR suite, have been used by others to reduce NOT.[4,5] Some hospitals also have used induction rooms to perform regional or local anesthesia outside of the OR.[2] Induction rooms need to be in close proximity to the ORs that they serve, which adds additional space and costs to OR suite construction. The use of induction rooms has also been associated with the need to hire extra anesthesia and nursing personnel to optimize the effectiveness of their use.[1,2,4] This need for additional construction and personnel has been a major limitation to their adoption. We did not use an induction room; all anesthetics were administered in the OR.

Most studies that have attempted to improve OR efficiency have limited the number of surgeons and other personnel involved.[4] While this may optimize the results, it restricts the broad application of process changes to most ORs. Our process redesign had explicit goals to not limit the participants and to maintain the current level of personnel to avoid increasing costs.

The ultimate goal of improving OR efficiency is to allow an increased number of cases to be performed in a given room. A previous report by Dexter and Macario[7] concluded that improving TOT yielded no benefit since the number of minutes saved was insufficient to allow an extra case to be completed. Their conclusion was based on the inclusion of cases with long operative times. By applying process redesign to ORs when case time is shorter (≤2 hours), there is greater opportunity to accumulate enough time in a given room during the course of the day to do additional cases.[1] These same principles do not apply to rooms in which operative times are longer and there are few turnovers per day. We are currently expanding our process to a greater number of ORs to attain optimal benefits from these efficiency improvements and expect that this should increase the number of cases done per room.

Decreasing NOT should be accompanied by a reduction in the number of delayed cases during the course of a day. Delays in the OR often increase anxiety for patients and their families, and are a source of frustration for the OR staff. Although we did not specifically measure patient or family satisfaction, we would expect that satisfaction would improve with better "on time" performance of cases. Friedman and coauthors[2] have demonstrated that patient satisfaction remained at a high level after process redesign to improve OR efficiency in a single OR.

There are a number of limitations of our study. We applied this process in only 2 rooms and limited our criteria for inclusion to cases scheduled for the duration of 2 hours or less. Data were collected for only a 3-month period. Sustaining these improvements may prove difficult without continuous monitoring and review. Expanding these changes to other rooms will obviously require the "buy in" of additional personnel who may not be as enthusiastic about improving efficiency. Maintaining consistently short NOT requires a high level of commitment from all the team members who may be motivated by various factors. As more ORs are added to the project, additional manpower may be required to cope with the workload associated with an increased number of cases. The majority of cases done in the project rooms were outpatient or same-day admit cases. Whether these same principles can be applied to inpatients is speculative. Inpatient operations provide additional challenges including efficient and timely transportation of the patient to the OR suite and avoidance of long periods of time in the preoperative holding area where the patient may need to be monitored by other hospital personnel.

Improving OR efficiency has been associated with increased stress among OR personnel. Stahl[8] assessed burnout in an efficiency project involving a single OR using a standard survey and reported a lower sense of personal accomplishment among nurses and more emotional exhaustion among surgeons. Adding tasks or cases can be a source of stress and consternation for busy OR personnel. It is imperative to provide benefit for those who create and sustain these efficiencies. Some suggestions include increased time for nurses to perform nonclinical activities that is based on the amount of time saved as well as rewards such as support for

educational meetings and other professional activities. There must also be rewards for surgeons and anesthesiologists to increase OR efficiency. Surgeons benefit primarily from increased clinical productivity by doing additional cases or by having extra time when cases are completed.[2] The facility benefits financially as long as additional costs are not incurred. All participants will benefit from improved patient satisfaction.

Delays encountered in the OR suite can be categorized as avoidable and unavoidable. Unavoidable delays would include late arrival of the patient or abrupt changes in clinical condition. Most of the delays in the present study are potentially avoidable, and efforts to correct these problems provide additional opportunities to improve efficiency. Notably, the scanning of operative permits into the hospital information database was implemented to help eliminate a significant reason for delays on the day of surgery. Even with this change in practice, 8% of delays during the project were related to this new process not being followed.

In summary, we have demonstrated that a coordinated multidisciplinary process redesign can significantly reduce NOT. This process is applicable to most OR suites and appears to have optimal benefit for cases 2 hours or less in duration. The use of mobile table tops was an additional advantage that contributed to improved efficiency. The high percentage of residual process-related delays suggests that further improvements can be anticipated and should be expected.

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REFERENCES

1. Cendán JC, Good M. Interdisciplinary work flow assessment and redesign decreases operating room turnover time and allows for additional caseload. Arch Surg 2006;141:65-9.
2. Friedman DM, Sokal SM, Chang Y, Berger DL. Increasing operating room efficiency through parallel processing. Ann Surg 2006;243:10-4.
3. Hanss R, Buttgereit B, Tonner PH, et al. Overlapping induction of anesthesia. Anesthesiology 2005;103:391-400.
4. Torkki PM, Marjamaa RA, Torkki MI, Kallio PE, Kirvelä OA. Use of anesthesia induction rooms can increase the number of urgent orthopedic cases completed within 7 hours. Anesthesiology 2005;103:401-5.
5. Sandberg WS, Daily B, Egan M, et al. Deliberate perioperative systems design improves operating room throughput. Anesthesiology 2006;103:406-18.
6. Malangoni MA. Assessing operating room efficiency and parallel processing. Ann Surg 2006;243:15-6.
7. Dexter F, Macario A. Decrease in anesthesia controlled time cannot permit one additional surgical operation to be reliably scheduled during the workday. Anesth Analg 1995; 81:1263-8.
8. Stahl JE, Egan MT, Goldman JM, et al. Introducing new technology in to the operating room: Measuring the impact on job performance and satisfaction. Surg 2005;137:518-26.

DISCUSSION

Dr Layton F. Rikkers (Madison, Wis). Dr Malangoni and colleagues are to be congratulated on accomplishing what heretofore has been a nearly impossible task for academic medical centers, namely decreasing the turnover time in the operating rooms.

To me the key message from your report is that, rather than the various stakeholders pointing fingers of blame at each other for causing operating room delays, they have joined together as a multidisciplinary team to get the job done. Working together really does work.

I commend this manuscript to any of you who want to achieve similar results in your operating rooms. There are several practical and doable tips such as using mobile exchangeable operating table tops, placing monitoring leads in the holding area, mandating that signed informed consent be completed in the surgeons' offices, and parallel processing (ie, getting 2 things done at the same time).

With patient safety being the highest priority in any operating room, does parallel processing, e.g. beginning cleaning of the room while the patient is being moved, have any adverse effects? This is a high-risk time for the patient and we have generally insisted that all attention be directed toward the patient during it. Does cleaning of the operating room while the next case is being set up violate any infection control principles?

Were all the players involved accountable to the same authority in the operating room? We have had the problem of housekeeping personnel in the operating room being accountable to managers outside of the operating room.

A key factor in any improvement we have had in our operating rooms is a separate room and anesthesia team for placement of epidermal catheters and for performing regional blocks. Did you use such an approach?

Why do you say this approach is helpful only in rooms with relatively short cases? If I have 2 big cases on, I certainly appreciate a rapid turnover so that I can better utilize my time. That in turn will free the other personnel in my room to help with other aspects of the overall operating room function.

Dr John Aucar (Tyler, Tex). The design of this study is appropriate, using concurrent controls. We usually advise against the use of historical controls, but here is a case where I wonder if it would be

valuable. The reason I ask this is that anyone could gain all kinds of efficiencies if we had enough resources to throw at a problem. Were the resources that you used to improve efficiency taken from the other side of the hallway, that is the rooms that were now being measured as the control? Did you notice or would you have predicted improvement in function or performance in those other rooms just by the Hawthorne effect?

Dr Sidney F. Miller (Columbus, Ohio). It has always been interesting to me to go to ambulatory surgery centers—the turnover is very fast and they get the schedule is usually finished an hour or two ahead of time. In most surgicenters, the personnel work on salaries. If they get their cases done, they get the same amount of money and might go home early. In the hospital, however, the staff attitude is "If I get my room done early all I am going to do is pick up more cases," so there is no incentive to speed the schedule up. I am wondering what kind of thoughts you might have on how we can have the same kind of efficiencies we see from the surgicenters in a busy hospital setting.

Dr Thomas A. Stellato (Cleveland, Ohio). It seems like long-term success is going to depend on being able to reward individuals and incentivize them to continue these efforts. Were you able to derive any financial benefits from this study so that compensation could be given back to those participants?

Dr Scott A. Engum (Indianapolis, Ind). I would ask whether we have the complete picture. If you do not look at events that occur during the surgical procedure itself, have you really optimized your time? How many times did the nursing staff have to leave the room to gather equipment or supplies, or do computer documentation that may have delayed the case? Did you look at any other factors during the case that wasted time?

Dr Fabrizio Michelassi (New York, NY). I think this is a study that all of us should duplicate in our own institutions. In my opinion, there is another large block of wasted and unused time in the operating room caused by delays at the beginning of the day. I was wondering if you also looked at on-time starts in the morning and whether the causes for delays in the morning are similar to the ones that you experienced at turn-around time.

Dr Mark A. Malangoni. We try to use the philosophy of working smarter and not harder. This is very important when you do one of these redesigns. We did involve our infection control personnel. They had no concerns about environmental cleanup, because we made sure that we didn't begin cleaning until the bandage was applied. There were some other things that we proposed that they were not in favor of, so we just didn't institute those.

One of the great successes of this project was the tremendous response of our environmental services people. They really stepped up to the plate and were stellar performers. It points out the importance of including ancillary services in the process redesign. Because they were involved with this process, they told us what they could do to make it work better. And they delivered.

We did not look at regional anesthetic blocks. Other institutions have reported on the use of an induction area or a room specifically to administer regional or local blocks. That works very effectively and is another way in which to decrease nonoperative time.

I would agree that you can apply some of these principles to longer cases as well. You will not be able to add another case on during the day by saving that time in rooms with very few turnovers, which is a disadvantage. But you do accrue other advantages. People are done sooner in the day, they have more time for other nonclinical duties, and you may save some overtime, while improving on-time performance, which I think does lead to improved patient satisfaction as well as better satisfaction for those who work in the OR.

Dr Aucar, one of the principles we stated at the beginning of the project is that we would not add personnel in order to make this work. We did not add any nurses or other personnel throughout our entire project. You are correct to ask about the Hawthorne effect. I am happy to say that our turnover time in the control rooms decreased by 5 minutes per turnover compared to the historical performance in those rooms with data collected prospectively before we instituted the trial.

Drs Miller and Stellato asked about rewards. This is extremely important, particularly for the nurses. We tried to institute a reward system. This is always difficult because of a lot of different reasons. But we thought that the reward could be giving the nurses increased nonclinical time as a reward for performance, and if they did get an extra case we would try to provide them some educational time or educational benefits that they would value. In fact, we came up with this idea by asking them for their input.

Dr Engum asked about some other aspects of operative time, which we did not examine. They are other very important areas where you can improve performance. Our nurses do routine computer entry, they have become masterful at it, and,

for most of them, it does not delay their time in the operating room or contribute to increased nonoperative time.

Dr Michelassi asked about our on-time performance at the beginning of the day. We traditionally get about 75% to 80% of our cases begun within 5 minutes of our projected start time. The performance in these two particular rooms was slightly better than that, and can be attributed to the commitment of the anesthesiologists, nurses, and surgeons involved.

Lastly, I would be remiss not to point out that residents were involved from both surgical and anesthesia services in all of these cases. So we were able to do this in a teaching setting, which is also very important.