

Impact of Preoperative Briefings on Operating Room Delays

A Preliminary Report

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Hypothesis: Preoperative briefings have the potential to reduce operating room (OR) delays through improved teamwork and communication.

Design: Pre-post study.

Setting: Tertiary academic center.

Participants: Surgeons, anesthesiologists, nurses, and other OR personnel.

Intervention: An OR briefings program was implemented after training all OR staff in how to conduct preoperative briefings through in-service training sessions. During the preoperative briefings, the attending surgeon led OR personnel in a 2-minute discussion using a standardized format designed to familiarize caregivers with each other and the operative plan before each surgical procedure.

Main Outcome Measures: The OR Briefings Assessment Tool was distributed to OR personnel at the end of each operation. Survey items questioned OR personnel

about unexpected delays during each procedure and the relationship between communication breakdowns and delays. Responses were compared before and after the initiation of the preoperative briefings program.

Results: The use of preoperative briefings was associated with a 31% reduction in unexpected delays; 36% of OR personnel reported delays in the preintervention period, and 25% reported delays in the postintervention period ($P < .04$). Among surgeons alone, an 82% reduction in unexpected delays was observed ($P < .001$). A 19% reduction in communication breakdowns leading to delays was also associated with the use of briefings ($P < .006$).

Conclusions: Preoperative briefings reduced unexpected delays in the OR by 31% and decreased the frequency of communication breakdowns that lead to delays. Preoperative briefings have the potential to increase OR efficiency and thereby improve quality of care and reduce cost.

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OPERATING ROOM (OR) time is expensive, costing an estimated \$15 per minute,¹ and is a big contributor to the total cost of surgical services, which constitute approximately 40% of hospital revenue.² Efficiency in the OR is increasingly used as a marker of the quality of surgical care. As a result, efforts to improve efficiency and quality in the hospital setting are often focused on reducing preventable delays in the OR.² To this end, the Institute of Medicine, in its seminal report *Crossing the Quality Chasm*,³ identified efficiency and timeliness as 2 of 6 areas for improvement for US hospitals.

Nearly all studies on improving OR efficiency and decreasing delays focus on clinicians' technical tasks rather than team

tasks. Some of these studies focus on the role of the anesthesiologist and propose overlapping patient inductions, using separate induction rooms, or changing induction techniques.⁴⁻⁶ Other studies recommend a total process management approach.^{7,8} Although a number of these studies suggest the importance of teamwork and communication in reducing delays, none of them evaluate interventions aimed at increasing intraoperative communication and collaboration.

We developed an OR briefing tool⁹ to enhance communication among members of the OR team. During a briefing, the team has a discussion just prior to skin incision to familiarize the team with the plan for the operation and review a checklist of important items (eg, thromboembolic prophylaxis, potential haz-

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ards, instrumentation). The purpose of the briefings is to formulate and share the operative plan, to promote teamwork, to mitigate hazards to patients, to reduce preventable harm, and to ensure all required equipment is available. However, the impact of OR briefings on delays is unknown. The specific aim of this study was to evaluate OR delays before and after the introduction of the OR briefing tool.

METHODS

STUDY DESIGN AND POPULATION

We used a pre-post design to evaluate the impact of briefings on operative delays. The preintervention period was 2 months, the intervention period was 3 months, and the postintervention period was 2 months. To evaluate delays, we used a case-based version of the Safety Attitudes Questionnaire (SAQ, OR version¹⁰) called the OR Briefing Assessment Tool (ORBAT), from May through November 2005. The study setting was the general ORs of an academic medical center (the Johns Hopkins Bayview Medical Center) where a defined set of 14 surgeons operate (7 general surgeons, 2 plastic surgeons, 3 neurosurgeons, and 2 urologic surgeons).

Of these 14 surgeons, 11 agreed to implement briefings and formed the study population (6 general surgeons, 2 plastic surgeons, 2 neurosurgeons, and 1 urologic surgeon). The ORBAT was administered to OR staff, including physicians and nurses, at the end of each operation performed by a participating surgeon. Sampling was not used owing to the small sample sizes for diverse health care provider roles in the OR, which would threaten the generalizability of the data. Instead, a high response rate was sought to capture the representative assessments of each caregiver type in the OR.

OR DELAYS

To evaluate delays we surveyed OR staff using the ORBAT tool at the end of each procedure. Delays were measured with 2 ORBAT questions: (1) "There was an unexpected delay related to the case" and (2) "Communication breakdowns that lead to delays in starting surgical procedures are common." We included all caregiver assessments of delays, rather than just 1 response per operation. The study was not designed to match respondents in the preintervention and postintervention periods.

OR BRIEFING ASSESSMENT TOOL

Survey questions were developed by generating a case-based version of the SAQ teamwork- and patient-safety-related items, which we have found to be associated with outcomes and error rates.^{11,12} The 17-question survey included questions relating the quality of teamwork and communication among health care providers in the OR and reports of delays during a procedure and in the institution overall. Response options for each item ranged from 1 (disagree strongly) to 5 (agree strongly).

THE BRIEFING PROGRAM

The OR briefing checklist, OR Briefing 5, is a tool to enhance communication among OR team members and improve patient safety (**Figure 1**). Our 2-minute OR briefing familiarizes health care providers with each other and with the operative plan through 3 critical components: each member of the OR team states his or her name and role; the surgeon leads the

- What are the **names and roles** of the team members?
- Is the correct patient/procedure confirmed? (**TIME-OUT**)
- Have **antibiotics** been given? (if appropriate)
- What are the **critical steps** of the procedure?
- What are the **potential problems** for the case?*

*Reviewed by nursing, anesthesia, and surgery.

Figure 1. Operating Room Briefing 5.

"timeout" as required by the Joint Commission on the Accreditation of Healthcare Organizations to identify critical components of the operation, including the surgical site; and the care teams discuss and mitigate potential safety hazards.^{9,13,14}

At the beginning of the intervention period, all OR staff were trained in how to conduct briefings through in-service training sessions using a standardized format that has been described previously.⁹ Training sessions were performed at a surgical faculty meeting, a departmentwide staff meeting, and a nursing administration meeting for all OR nurses and technicians. A surgeon champion (M.A.M.) also met individually with each surgeon in the program. An independent study coordinator observed each surgical procedure to evaluate compliance with briefings in the OR during the study period.

STATISTICAL ANALYSIS

The unit of analysis was the clinician. We report the percentage agreement (agree slightly + agree strongly) for items in the preintervention and postintervention periods. Using a *t* test, we analyzed pre-post differences in responses and percentage agreement for the 2 OR delay items on the ORBAT survey instrument. A response of "neutral" was interpreted as the survey respondent not having enough information to make a definitive assessment and was accordingly excluded from the analysis. All statistical analyses were performed using SPSS statistical software, version 13.0 (SPSS Inc, Chicago, Illinois).

RESULTS

The preintervention ORBAT response rate was 85.0% (306 of 360 participants), and the postintervention response rate was 75.3% (116 of 154 participants). There were 422 total respondents, including surgical attending physicians (20.4%), surgical residents (14.5%), anesthesia attending physicians (9.5%), anesthesia residents (4.5%), certified registered nurse anesthetists (8.1%), scrub nurses (17.3%), circulating nurses (19.0%), medical students (3.8%), nurse assistants (1.0%), and "other" (2.0%) (**Table 1**). After excluding unmarked and neutral responses, there were 357 of the 422 responses (85%) to the statement "there was an unexpected delay related to the case" and 368 responses (87%) to "communication breakdowns that lead to delays in starting surgical procedures are common" (**Table 2**).

Caregiver assessments of OR delays improved for both items: "there was an unexpected delay related to the case" (preintervention, 36% agreed; postintervention, 25% agreed; $P < .04$) (**Table 3**) and "communication breakdowns that lead to delays in starting surgical procedures are common" (preintervention, 80% agreed; postintervention, 65% agreed; $P < .006$) (**Figure 2**). Among surgeons alone, the percentage reporting unexpected de-

Table 1. Respondent Characteristics

Respondent Type	No. (%) of Respondents ^a
Attending surgeon	86 (20.4)
Surgical resident	61 (14.5)
Attending anesthesiologist	40 (9.5)
Anesthesiology resident	19 (4.5)
Certified registered nurse anesthetist	34 (8.1)
Scrub nurse	73 (17.3)
Circulating nurse	80 (19.0)
Nurse assistant/physicians' assistant	6 (1.4)
Medical student	16 (3.8)
Other/missing	7 (1.7)
Total	422 (100)

^aBecause of rounding, percentages do not sum to 100.

lays decreased from 38% to 7% from preintervention to postintervention ($P < .001$).

COMMENT

In our study, the use of OR briefings was associated with a 31% reduction in OR delays. Delays in the OR are a major component of the quality, efficiency, and work environment of surgical care. Decreased OR delays allow for increased surgical capacity, resulting in shorter waiting times for patients with acute illness ("add-on" cases), lower nurse turnover rates, and increased job satisfaction. These factors are often associated with safety because improved efficiency and capacity mean that more operations are performed during the daytime, when important backup personnel are readily available, and fewer operations are performed at night, when skeleton teams who may be unfamiliar with one another are more likely to work together. Thus, OR briefings have the potential to improve both quality and safety¹⁵ while decreasing costs and creating a more favorable and predictable work environment.

We have previously reported the positive impact of the OR briefings program on wrong-site surgery¹⁶ and OR culture.¹³ Here, we link an improvement in OR delays with a reduction in communication breakdowns leading to delays. This link suggests that improvements in communication, teamwork, and planning are the driving forces behind how briefings reduce OR delays. Numerous studies have noted the importance of teamwork in the OR in terms of patient safety and patient outcomes.^{17,18} In this study, we found that OR delays also benefited from a team-oriented OR culture.

The use of standardized procedures is generally accepted as a strategy to improve technical work. This study provides support for the idea that standardized procedures for communication, through OR briefings, also improve teamwork and OR delays. Efforts to standardize communication, such as through OR briefings, may be an effective strategy for improving patient safety.

Assessing the correlates and consequences of a delay in the OR is time-consuming, expensive, and often subjective. In one study⁷ conducted at a major academic hospital, only 77% of 1881 anesthesia records were correctly completed. Given that delays are difficult to quantify

and case-specific, we concluded that the best judges of delays during a case are the OR staff involved with the case. Such firsthand assessment is logistically more feasible and, we believe, captures the dynamic nature of the OR in real time. Given the time and expense of measuring OR delays, the ORBAT may serve as a valuable tool to evaluate the effectiveness of interventions to improve OR efficiency.

LIMITATIONS

We recognize some important limitations to this study. First, we determined caregiver assessments of issues related to delays using the ORBAT, rather than measuring the duration of delays. Assessments are inherently subjective, and survey items are open to interpretation. We chose this method because it addresses the unexpected nature of the delays, allowing health care providers to decide whether delays were expected for the given operation (ie, a surgical exploration for a more invasive cancer than expected or a procedure in which a patient has an anatomical variation). Furthermore, scores on the SAQ have been associated with important clinical and operational outcomes in the OR.¹⁷ Second, we used a pre-post design without a control group, rather than a randomized design. We recognize the methodological weakness in our exclusion of a control group and our inability to track OR personnel at the surgical case level. Because nurses and anesthesiologists work with multiple surgeons, we believed a randomized design was not feasible in this early stage of the research, and the control group would likely be contaminated by OR personnel who were trained in briefings. The sample we chose allowed us to introduce the intervention to all the relevant personnel in 1 campaign. Nevertheless, an important lesson learned for future research and implementation of OR briefings is the need to focus on the surgeon as the unit of analysis, such that each surgeon is assigned to a control or experimental group and OR personnel are grouped with their surgeon for pre-post analyses. Third, not all the surgeons invited to implement the briefing program agreed to participate, introducing the possibility of selection bias. Finally, we studied a single academic medical center, and each institution has its own barriers to changing the culture and procedures of the OR.

IMPLICATIONS

The use of OR briefings as a routine procedure to reduce preventable surgical risks and delays has many implications for practice and training. These data suggest that hospitals should consider implementing briefings as a strategy to improve clinical and economic outcomes in surgical patients. We have previously shown that there are significant differences in perceptions of teamwork in the OR. In a study of 2135 OR personnel in 60 hospitals, we found that surgeons rated nurses as having good teamwork 87% of the time, whereas nurses rated the teamwork of surgeons as positive 48% of the time.¹⁸ This discrepancy in perceptions of teamwork in the OR implies that strategies are needed to align expectations of teamwork among physicians and nurses. It was this finding that served as the im-

Table 2. ORBAT Delay Items

ORBAT Item	Mean Score ^a (95% CI)		Difference	P Value ^b
	Preintervention	Postintervention		
There was an unexpected delay related to the case	2.4 (2.3-2.6)	2.1 (1.8-2.4)	-0.3	<.04
Communication breakdowns that lead to delays in starting surgical procedures are common	3.9 (3.7-4.0)	3.4 (3.1-3.7)	-0.5	<.002

Abbreviations: CI, confidence interval; ORBAT, Operating Room Briefing Assessment Tool.

^aMean score on a scale of 1 to 5, with 5 indicating "agree strongly." Responses of 3 or "neutral" were excluded from the analysis.

^bThe *t* test was applied assuming equal variances.

Table 3. Unexpected Delays Reported Preintervention and Postintervention

Respondents	% Reporting Unexpected Delays ^a (95% CI)		RR Reduction, %	P Value ^b
	Preintervention	Postintervention		
All	36 (30-42)	25 (17-33)	31	<.04
Surgeons (attending and residents)	38 (28-48)	7 (0-15)	82	<.001

Abbreviations: CI, confidence interval; RR, relative risk.

^aPercentage agreement with the Operating Room Briefing Assessment Tool item "There was an unexpected delay related to the case" on a scale of 1 to 5, with 4 or 5 indicating agreement. Responses of 3 or "neutral" were excluded from the analysis.

^bThe *t* test was applied assuming equal variances.

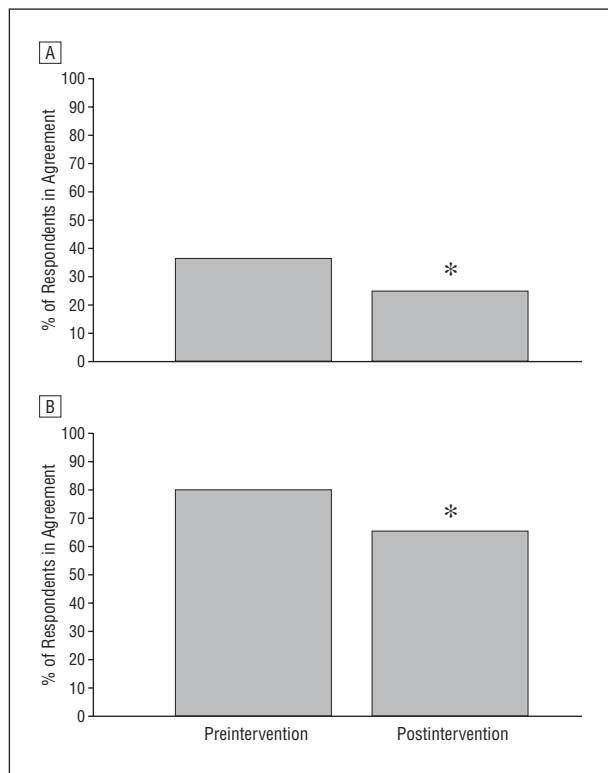


Figure 2. Percentage agreement for 2 delay-related items on the Operating Room Briefing Assessment Tool preintervention and postintervention:

A, "There was an unexpected delay related to the case" and B, "Communication breakdowns that lead to delays in starting surgical procedures are common." Asterisks indicate significance of difference in percentage agreement at $P < .05$.

petus to study the impact of briefings on OR culture. Strategies such as OR briefings may help toward reducing the discrepancy in perceptions of teamwork and the roles various health care providers serve in fostering teamwork. At

our institution, OR briefings are conducted before all operative procedures and are taught to surgical and anesthesia residents as part of a patient safety curriculum.

FUTURE DIRECTIONS

The OR briefing tool we developed and used in this study is a framework for more specific checklists designed for individual specialties and operations. For example, in performing an organ transplant operation, a confirmation of the crossmatch result or organ blood type may be important. We are still exploring the relative benefits and risks of standardizing the briefing tool across all ORs or allowing local modification. Our hope is that the discussion and not the script of the OR briefing we used will be implemented to improve teamwork, identify and mitigate preventable harm, and increase efficiency. Ultimately, a customized checklist that is continually revisited and revised to meet the changing needs of ORs and surgical techniques will result in improved quality and safety.

CONCLUSIONS

The use of OR briefings was associated with a reduction in delays and communication failures that led to delays. Hospitals should consider implementing OR briefings as a strategy to improve OR efficiency and clinical and economic outcomes in surgical patients.

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REFERENCES

1. Bacchetta MD, Girardi LN, Southard EJ, et al. Comparison of open versus bedside percutaneous dilatational tracheostomy in the cardiothoracic surgical patient: outcomes and financial analysis. *Ann Thorac Surg.* 2005;79(6):1879-1885.
2. Rutter T, Brown A. Contemporary operating room management. *Adv Anesth.* 1994; 11:173-214.
3. Institute of Medicine Committee on Quality of Health Care in America. *Crossing the Quality Chasm: A New Health System for the 21st Century.* Washington, DC: National Academy Press; 2001.
4. Hanss R, Buttgerit B, Tonner PH, et al. Overlapping induction of anesthesia: an analysis of benefits and costs. *Anesthesiology.* 2005;103(2):391-400.
5. Torkki PM, Marjamaa RA, Torkki MI, Kallio PE, Kirvela OA. Use of anesthesia induction rooms can increase the number of urgent orthopedic cases completed within 7 hours. *Anesthesiology.* 2005;103(2):401-405.
6. Sandberg WS, Daily BM, Egan M, et al. Deliberate perioperative systems design improves operating room throughput. *Anesthesiology.* 2005;103(2):406-418.
7. Overdyk FJ, Harvey SC, Fishman RL, Shippey F. Successful strategies for improving operating room efficiency at academic institutions. *Anesth Analg.* 1998; 86(4):896-906.
8. Weinbroum AA, Ekstein P, Ezri T. Efficiency of the operating room suite. *Am J Surg.* 2003;185(3):244-250.
9. Makary MA, Holzmueller CG, Thompson D, et al. Operating room briefings: working on the same page. *Jt Comm J Qual Patient Saf.* 2006;32(6):351-355.
10. Sexton JB, Helmreich RL, Neilands TB, et al. The Safety Attitudes Questionnaire: psychometric properties, benchmarking data, and emerging research. *BMC Health Serv Res.* 2006;6:44.
11. Makary MA, Sexton JB, Freischlag JA, et al. Patient safety in surgery. *Ann Surg.* 2006;243(5):628-635.
12. Sexton JB, Thomas EJ, Helmreich RL. Error, stress, and teamwork in medicine and aviation: cross-sectional surveys. *BMJ.* 2000;320(7237):745-749.
13. Lingard L, Reznick R, DeVito I, Espin S. Forming professional identities on the health care team: discursive constructions of the "other" in the operating room. *Med Educ.* 2002;36(8):728-734.
14. Dwyer K. Surgery-related claims and the systems involved. *J Med Pract Manage.* 2003;18(6):332-336.
15. Michaels RK, Makary MA, Dahab Y, et al. Achieving the National Quality Forum's "Never Events": prevention of wrong site, wrong procedure, and wrong patient operations. *Ann Surg.* 2007;245(4):526-532. doi:10.1097/01.sla.0000251573.52463.d2.
16. Makary MA, Mukherjee A, Sexton JB, et al. OR briefings and wrong-site surgery. *J Am Coll Surg.* 2007;204(2):236-243.
17. Makary MA, Sexton JB, Freischlag JA, et al. Operating room teamwork among physicians and nurses: teamwork in the eye of the beholder. *J Am Coll Surg.* 2006;202(5):746-752.
18. Sexton JB, Makary MA, Tersigni AR, et al. Teamwork in the operating room: front-line perspectives among hospitals and operating room personnel. *Anesthesiology.* 2006;105(5):877-884.