Development and Pilot Evaluation of a Preoperative Briefing Protocol for Cardiovascular Surgery

Sarah E Henrickson, MA, Rishi K Wadhera, BS, Andrew W ElBardissi, MD, MPH,
Douglas A Wiegmann, PhD, Thoralf M Sundt III, MD

BACKGROUND: Preprocedural briefings have been adopted in many high consequence environments, but have not been widely accepted in medicine. We sought to develop, implement, and evaluate a preoperative briefing for cardiovascular surgery.

STUDY DESIGN: The briefing was developed by using a combined questionnaire and semistructured focus group approach involving five subspecialties of surgical staff (n = 55). The results were used to design and implement a preoperative briefing protocol. The briefing was evaluated by monitoring surgical flow disruptions, circulating nurse trips to the core, time spent in the core, and cost-waste reports before and after implementation of the briefing across 16 cardiac surgery cases.

RESULTS: Focus group data indicated consensus among surgical staff concerning briefing benefits, duration, location, content, and potential barriers. Disagreement arose concerning timing of the brief and the roles of key participants. After implementation of the briefing, there was a reduction in total surgical flow disruptions per case (5.4 preimplementation versus 2.8 postimplementation, $p = 0.004$) and reductions in per case average of procedural knowledge disruptions (4.1 versus 2.17, $p = 0.004$) and miscommunication events (2.5 versus 1.17, $p = 0.03$). There was no significant reduction in disruptions because of equipment preparation or disruptions from patient-related issues. On average, briefed teams experienced fewer trips to the core (10 versus 4.7, $p = 0.004$) and spent less time in the core (397.4 seconds versus 172.3 seconds, $p = 0.006$), and there was a trend toward decreased waste (30% versus 17%, $p = 0.15$).

CONCLUSIONS: These findings demonstrate the feasibility of creating a specialty-specific preoperative briefing to decrease surgical flow disruptions and improve patient safety in the operating room. (J Am Coll Surg 2009;208:1115–1123. © 2009 by the American College of Surgeons)

Effective communication and teamwork have been recognized as critical drivers of quality and safety in many "high consequence" industries. High consequence industries are those in which critical procedures are conducted in environments of high complexity and failure is potentially catastrophic.[1] Effective communication is particularly critical when processes are "tightly coupled" such that failures in one subsystem are directly reflected or even amplified in others, as may be the case in surgery. In health care specifically, there is increasing recognition that breakdowns in communication or teamwork are causal factors in as many as 65% sentinel events, as per the Joint Commission.[2] Within the surgical domain, one analysis demonstrated incomplete, nonexistent, or erroneous communication to be a causal factor in 43% of errors.[3] Examined conversely, a study specifically of communication errors demonstrated that 36% of communication errors in the operating room resulted in team tension, resource waste, work-arounds, inefficiency, delays, patient inconvenience, and procedural errors.[4] The same study also showed that as many as 30% of operating room communications fail in one regard or another, either because of poor timing (46%), inaccurate or incomplete information (36%), issues remaining unresolved (24%), or failure to include key personnel (21%). In 33% of these failures there are effects that increase cognitive work load, interrupt routine, or increase tension.[4]

Preprocedure briefings are commonplace in many high consequence industries. Accordingly, it is not surprising

Disclosure Information: Nothing to disclose.

Received October 29, 2008; Accepted January 15, 2009.
From the Division of Cardiovascular Surgery (Henrickson, Sundt) and the College of Medicine (Wadhera), Mayo Clinic, Rochester, MN; the Institute of Public Health, University of Cambridge, Cambridge, England (Wadhera); the Department of Surgery, Brigham and Women's Hospital, Boston, MA (ElBardissi); and the Department of Industrial and Systems Engineering, University of Wisconsin-Madison, Madison, WI (Wiegmann).
Correspondence address: Sarah E Henrickson, MA, Mayo Clinic, 200 First St SW, Rochester, MN 55005.

Published by Elsevier Inc.

ISSN 1072-7515/09/$36.00
doi:10.1016/j.jamcollsurg.2009.01.037

that the utility of preoperative briefings in surgery is being explored by a number of groups. Preoperative briefings have been shown to increase team satisfaction,[5-7] patient safety, and safety climate,[7] decrease miscommunications,[8] and increase compliance with the elements of the surgical time out.[9] The World Health Organization also recently created a general checklist to improve surgical outcomes in various surgical specialties.[10] But the majority of such studies evaluating team communication and integration of a briefing protocol, have been in the fields of general surgery[7,8,11] or anesthesia.[5] In the domain of cardiovascular surgery specifically, we previously showed that only 32% of nonphysician caregivers in our own operating rooms believe that surgeon communication is effective.[12] In the same study, 59% of nonphysician respondents thought that surgeon attitudes and personalities negatively affected teamwork. Additionally, we demonstrated that surgical flow disruptions are directly related to technical errors, and that of these disruptions, communication and teamwork failures show the strongest correlation to technical error.[13] Subsequent reanalysis of these data suggested that an intervention such as a preoperative briefing had the potential to ameliorate these disruptions.[14]

Despite the potential benefits of preoperative briefings, their use remains relatively infrequent within many surgical specialties. This may be in part from the specific needs within those subspecialties and the lack of standardized protocols or templates for conducting preoperative briefings. So a “generic” surgical checklist may not suffice. In particular, despite the remarkably high complexity and high consequence nature of cardiovascular surgery, with tightly coupled processes and multiple teams of individuals with diverse backgrounds and diverse expectations involved in every surgical case,[15] briefings have not been widely adopted in our field.

So we sought to develop and pilot a briefing tool specific to cardiovascular surgery with the specific aim of determining its effectiveness and barriers to adoption and implementation.

METHODS

The Mayo Clinic Institutional Review Board approved this study as having minimal risk.

Development of the briefing

A cardiac surgery-specific briefing was developed in a collaborative manner to assure sensitivity to the needs and views of all members of the care team.[5] Using a combined questionnaire (Fig. 1) and semistructured focus group methodology, input was sought from 56 members of the surgical team including certified surgical assistants, certified surgical technicians, registered nurses (circulating nurses [CN]), perfusionists, and certified registered nurse anesthetists. Surgeon input was provided by the surgical coinvestigator (TMS) in consultation with his colleagues. The questionnaire provided an opportunity for subsequent analyses of responses on an individual basis. On completion of the questionnaire, a short, facilitated (DW) focus group session followed to discuss participants’ answers. For each question, a separate researcher (SH) took notes to capture the comments provided by the staff, the nature of any disagreements or discussions among staff members, and answers to followup questions posed by the facilitator.

Specialty: ______________________

Content of Briefing

1. What information/topics/issues should be discussed in a preoperative briefing from your perspective?
2. Is there information that others may know that you would like them to share with you, in order to help the case run more smoothly? If so, who has the information and what is it?
3. Is there information that you have that you don’t normally share that you would like others to know

Logistics

4. In your opinion, who should be present for a preoperative briefing?
5. When and where should it be done? (e.g.: in the OR before the pause)
6. How long should it take?
7. Who should lead it?

Challenges

8. What barriers may exist that could prohibit a preoperative briefing?
9. Would you like to see some sort of preoperative briefing implemented in the OR?

Figure 1. Questionnaire for development of the preoperative briefing.

The information was then aggregated, organized, and categorized using a grounded theory approach[16] based on the main themes that emerged from all participants: procedure, patient, and equipment information. The final briefing protocol used during pilot implementation is shown in Figure 2. With the aim of increasing engagement and promoting open verbal communication, the format of the briefing is participatory, with each member of the team asked to report their plan for the case, any questions related to their area of focus, and any other issues.

Pilot implementation of the preoperative briefing

Institution of the briefing protocol was piloted in one operating room to determine the potential value and the possible obstacles to more widespread adoption. To permit observation of the impact of the briefing on surgical flow disruptions and errors, briefings were trialed in only for the first case of the day, again to determine feasibility for integration into practice for subsequent cases. The briefing was designed to include the staff cardiac surgeon, staff anesthe-

1. RESIDENT (Surgeon)

History:
- Diagnosis
- Planned Procedure
- Significant past history
  - Low EF
  - Redo
    - CABG
    - Valve
  - Previous vein stripping
- Allergies

2. SURGEON (Resident)

- Cannulation
  - Arterial Cannula
    - Placement
      - Arch
        - Aneurysm
      - Axillary
      - Femoral
  - Venous Cannula
    - Placement
    - Type
      - Bi-caval
      - Two stage

3. SURGICAL ASSISTANT

- Length of Vein
- Positioning (IF Atypical)
- Prep (IF Atypical)

4. PERFUSIONIST

- Perfusion Pressure
- Perfusion Temperature
- Cannula Size
- Circulatory Arrest
  - Cool down temperature

5. SURGICAL TECH

- Suture
- Instrumentation

6. RN

- Valve type
- Graft
- Patch
- Special Precautions
- Concerns

7. ANESTHESIA/CRNA

- Line Placement
  - Arterial Line
    - Right
    - Left
    - Femoral
    - Radial
- Antifibrolytics
  - Aprotinin
  - Tranexamic Acid
- OR list management plan for the da

8. OTHER CONCERNS- UNIQUE TO THIS CASE

Figure 2. Prototype briefing checklist for cardiac surgery.

siologist, certified registered nurse anesthetist, certified surgical technician, certified surgical assistant, circulating nurse, and perfusionist. Although the surgeon (TMS) was held constant, other team members varied depending on the daily operating room assignments. Before participation, however, all team members were trained on the content and conduct of the briefing. Data were collected on a convenience sample of 10 on-pump cardiac surgical cases of all types before implementation of the preoperative briefing protocol and 6 after implementation.

Observations were made by one observer (RW) after didactic training in basic human factors principles and methods concerning the capture of surgical errors and flow disruptions by human factors professionals (DW, SH). Observations were made from the time of incision until termination of cardiopulmonary bypass. Causes of disruptions in surgical flow were categorized as patient-related issues, equipment or resource issues, procedural knowledge issues, and miscommunication events[12] (Table 1). We also assessed both the number of trips the CN took out of the operating room to the central supply area and the time spent out of the room to evaluate the effectiveness of the preoperative briefing in reducing surgical flow disruptions. The rationale for this end point was three-fold: First, the operating room team cannot be as efficient or as safe if all members of the team are not present in the room and the ability of the team to respond quickly to unforeseen circumstances is reduced if the CN is not present. Second, this is an outcome that will resonate with practicing surgeons who widely recognize the impediment to flow of an operation when the CN is out of the room and supplies need to be opened and "thrown" up to the field. Finally, this measure was chosen because it shows a specific observable behavior that is very unambiguous to the observer.

To ensure consistency among the observations, documented events were assessed independently by two raters (RW, SH) to determine if they met criteria to be considered a disruption and to evaluate the consistency of categorization of these disruption events. Surgical case length, cardiopulmonary bypass time, and cost-waste reports were also obtained from the electronic medical record.

Between preintervention and postintervention data collection, seven briefings were conducted and observed without subsequent observation of the cases to assess the briefing design and provide an opportunity for staff to become familiar with the briefing before data collection began during the surgical cases. Briefings were assessed on length (minutes), content, attendance of team members, and delay in start time. Postintervention observations were then made of the next six cases.

Table 1. Definition of Surgical Flow Disruptions

Disruption type	Definition	Example
Procedure-related	Team member not knowing how to perform a procedural step or actively performing a procedural step incorrectly	Uncertainty of surgeon preferences regarding operating field set up
Equipment-related	Equipment necessary for a procedure was not immediately available in the operating room, equipment was present in the operating room but not functioning correctly, the individual needed to operate equipment was not in the operating room, and surgical team member uncertain how to operate new equipment.	St Jude valve in room instead of Medtronic
Patient-related	Surgical staff unaware or uncertain of patients' medical conditions relevant to surgical case, patient history relevant to the surgery was conveyed inaccurately, or patient information was incorrectly or not displayed in the operating room.	Latex allergy, exact preoperative weight
Miscommunication-related	Verbal commands or inquiries not effectively conveyed or were secondary to a necessary command or request not being verbalized. Events could most often be attributed to incorrect interpretation of command or request by receiving staff member, noise, or failure of staff members to verbalize an action or procedural change.	Inotropes not started

Statistical analysis

Both quantitative and qualitative methods were used in analyzing the focus group and questionnaire data for development of the briefing. Descriptive and summary statistics were used (eg, means and frequencies) to quantify the number of participants who voiced similar concerns or ideas or the differences between specialties in terms of the types of concerns or ideas they may have had.

For the observational portion of the study, descriptive analyses were used to compare the overall number of surgical flow disruptions in the nonbriefing and briefing groups. A student's *t*-test was used to compare mean number of disruptions, with a $p < 0.05$ considered statistically significant. To validate the categorization of observations made in the operating room (into procedural knowledge issues, equipment preparation issues, patient-related issues, and miscommunication events), two raters independently categorized all documented flow disruptions that had been observed. There was 95% agreement in the categorical analysis of flow disruption types between the independent raters.

RESULTS

Development of the preoperative briefing

According to responses on the questionnaire, the majority (65%) of surgical staff answered that they would like a preoperative briefing implemented, 22% indicated that they did not want such a procedure implemented, and 13% expressed no opinion. Of those who said "no," the majority believed they were already conducting an informal briefing and feared that formalizing the process would detract from it. Others did not think it was a feasible or practical option. Of those who expressed no opinion, the majority indicated that they would be in favor if the briefing met certain specifications, such as timeliness, location, and proper staff availability.

A major concern was logistics. With respect to duration, 74% indicated that the briefing should be less than 10 minutes, with 30% asserting that it should last less than 5 minutes. The other 20% either indicated that the duration of the briefing should be "as long as it takes" or voiced no opinion. With regard to time and location, 69% of the staff thought that the briefing should be conducted after the initial set-up of the operating room, but before the patient arrived; 19% indicated the briefing should take place with the patient in the room. Only 14% of surgical staff indicated that the briefing should take place before setting up the operating room or the patient entering the room. An overwhelming majority (95%) indicated that the briefing should take place within the operating room.

An intriguing insight into views of who were the critical members of the team was provided by responses to the question, "Who should be present for the preoperative briefing?" The circulating nurses generally listed the widest range of participants to be included in the briefing; the certified surgical technicians listed the narrowest. Perfusionists and certified registered nurse anesthetists rated themselves as very important to the briefing, but other disciplines rarely mentioned or listed them as key participants.

Suggested content of briefings was grouped according to themes, and percentages of respondents who mentioned the theme are indicated in Figure 3. The most common category of information was procedural (85%), with spe-

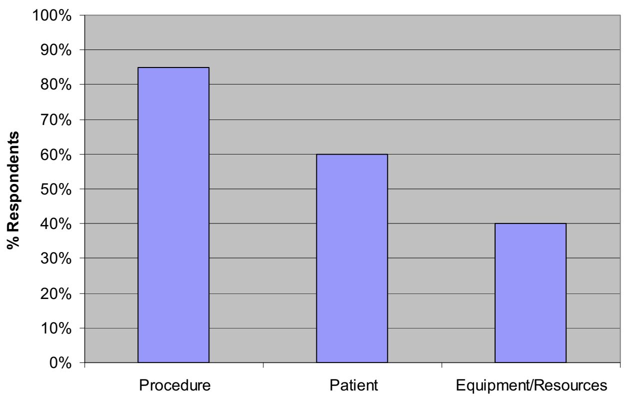

Figure 3. Percentage of participants who mentioned topics related to each information category to be discussed during the briefing. Note that percentages do not sum to 100% because participants could indicate more than one category.

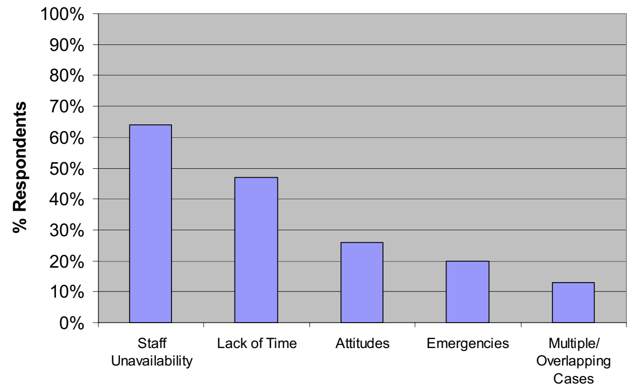

Figure 4. Percentage of participants who mentioned topics related to each barrier category. Note that percentages do not sum to 100% because participants could indicate more than one category.

cific attention to any "expected deviations from normal procedure," any "possible complications," and procedural concerns such as "cannula location," "what temperature to cool the patient to during bypass," the potential need to "prepare for circulatory arrest," and "the number of veins to be taken for the bypass graft," among others. The second common theme that emerged was information about the patient (57%) such as earlier procedures, concomitant diagnoses, current diagnosis, height and weight, risk factors, allergies, and religious concerns (eg, religious beliefs about blood transfusions). The third category related to equipment and resource information (36%) including arterial cannula size, type and size of grafts or patches to be used, any special supplies or instruments to be retrieved from the core, and any special equipment required for the procedure (eg, octopus bypass for nonpump case).

During the focus group discussions, it became clear that surgical staff already seek out this information individually from a variety of sources including the electronic medical record, the posted surgical list, and other available team members, but many participants indicated that this information is not always available or accurate, and they welcomed the opportunity to verify information before each surgical case. In addition, most of the team members believed that they often had information that they needed to share with other team members, but did not always have an opportunity to do so before the case.

Among the greatest concerns expressed were barriers to instituting the briefing (Fig. 4). The most commonly cited barrier was staff availability (64%). Comments included: "A major barrier will be when a team member is missing," "People are not going to wait if staff are not there . . . we need to get set up," and "Not everyone can be here at the same time." A related concern pertained to the availability of time for a briefing (49%). For example, "The morning start time is very, very busy: getting tubing pulled, checking on supplies, getting scrubbed, and setting up cases." "There are many circumstances that would delay the briefing (ie, the needs of the patients may need to be addressed at that time)." Another 25% of respondents were concerned that their other colleagues would have the "perception that it is a waste of time." Others commented that barriers would be "lack of compliance by all team members, others' attitudes ('I don't have time', 'not necessary'), there is no buy-in."

Finally, there were concerns (16%) expressed about the management of emergency operations, suggesting that there would be no time in such cases for briefings. Multiple or overlapping cases was also listed as a barrier by roughly 13% of participants (eg, "It would be relatively easy to brief the first case of the day, but many surgeons perform multiple cases per day, with various team members. Their cases also tend to overlap.").

Pilot implementation

The length of time required to accomplish the briefing fell rapidly during the roll-in period before evaluating its impact from 8 minutes to 1 minute, as shown in Figure 5. Delay in the start time for staff to assemble decreased from 9 minutes to 0 minutes, and attendance at the briefing remained steady. The content of the briefing was adjusted during this period to a final version (Fig. 2).

Characteristics of the 10 cases observed before implementation and 6 observed after implementation are shown in Table 2. The case mix was similar, as were the average length of the cases (245 minutes versus 229 minutes, $p = 0.62$) and cardiopulmonary bypass time (99.8 minutes versus 97.0 minutes, $p = 0.88$).

Based on our previous work,[12] our primary outcomes measure was surgical flow disruption, including procedural

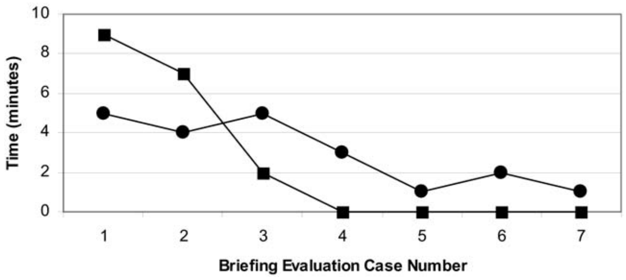

Figure 5. Evaluation of the briefing before evaluation of briefing impact. Circles, length of briefing; squares, delay in start time.

knowledge issues, equipment preparation issues, miscommunication events, and patient-related issues. The total frequency of surgical flow disruptions (Table 3), as shown in the proceding text decreased substantially after instituting briefings (9.5 versus 5.0, p = 0.0002).

Examples of procedural knowledge issues included initial administration of an incorrect dose of cardioplegia, confusion among surgical staff members about the prosthetic valve to be used, and arrangement of the surgical operative field incorrectly per surgeon preference. Procedural knowledge disruptions were reduced by almost half after introduction of the briefing (4.1 versus 2.17, p = 0.007).

Examples of miscommunication events included surgeon not being informed that heparin was administered, surgeon not hearing that phenylephrine had been administered, and the perfusionist not rewarming patient at the appropriate time because the surgeon had assumed the patient was being maintained at normothermia. Teams that were briefed had 53% fewer miscommunication events per case (2.5 versus 1.17, p = 0.03) than teams that were not briefed. Disruptions caused by failures in equipment preparation included specific sternal retractors being unavailable, the perfusionist not being present in the operating room when the surgeon was ready to go on bypass, and cryoblation equipment not present. The decrease in equipment preparation disruptions was less pronounced than other disruptions (1.9 versus 1.2, p = 0.25) and did not attain statistical significance. An example of a patient-related disruption was the inability to cool the patient's core to the desired temperature before controlled cardiac arrest because of patient's body mass. These disruptions to flow also declined (1.0 versus 0.5, p = 0.20) when surgical teams were briefed, but this decrease was not statistically significant.

In an effort to include more objectively quantitative outcomes variables, we assessed the impact of briefings on the number of trips the CN took to the central supply area (core) and the time spent there because this represents time that this member of the team is unavailable to carry out his or her role in the operating room. On average, surgical teams that were briefed had significantly fewer trips to the core per surgical case (10 versus 4.7, p = 0.008), as illustrated in Table 4. Consequently, less total time was spent in the core during surgical cases (6.6 minutes versus 2.9 minutes, p = 0.01). We also examined waste reports. They showed a trend toward decreased waste in teams that were briefed, but this difference did not attain statistical significance (p = 0.31). Additionally, the percentage of cases that had associated waste costs was lower postimplementation (30% versus 17%).

Finally, the institution of briefings has had a subjective but no less real impact on morale in the operating rooms. In our institution, surgeons simultaneously run two operating rooms. Although the pilot was conducted in only one room, staff from the second room quickly started gathering in the hall asking for a briefing for their room as well. Once the pilot was completed, the briefings had become so popular and anecdotally valuable that the surgeon involved (TMS) continued briefings even before analysis of the data despite initial skepticism.

DISCUSSION

This study demonstrates the feasibility of creating and instituting a cardiac surgery-specific preoperative briefing using a multidisciplinary collaborative approach. Use of this briefing reduces the occurrence of surgical flow disruptions in the cardiovascular operating room.

Surgical flow disruptions were chosen as an outcomes measure in light of our previous study, which indicated that such disruptions have a strong association with error in cardiovascular surgery.[13] Although these disruptions may

Table 2. Classification of Observed Procedure Types in Pre- and Post-implementation Groups

Group	Type of case	Cases observed (pre- and post-implementation), n
Control (not briefed)	Aortic root replacement	3
Control (not briefed)	Valve repair/replacement	6
Control (not briefed)	Ascending aorta replacement with valve repair/replacement	2
Preoperative briefing	Valve repair/replacement	5
Preoperative briefing	Ascending aorta replacement with valve repair/replacement	1

Table 3. Per Case Average of Total Surgical Disruptions, Procedural Knowledge Disruptions, and Miscommunication Events for Preimplementation and Postimplementation Groups

Variable	Preimplementation group, n	Postimplementation group, n	Decrease, %	p Value
Total surgical disruptions per case	9.5	5	47	0.0002
Procedural knowledge disruptions per case	4.1	2.17	46	0.007
Miscommunication events per case	2.5	1.2	53	0.03

appear to be minor events, studies have shown that the occurrence of such latent events can impede a surgical team's ability to compensate for a major event.[12] Research suggests that surgical flow disruptions occur more frequently in cases with a death or near miss outcome than in those with no adverse advents, even after adjustment for other patient characteristics.[17,18] Other studies have linked intraoperative factors such as increased cardiopulmonary bypass time to greater morbidity, and it is intuitive that a pause in procedure from a surgical flow disruption can prolong cardiopulmonary bypass time.[19,20] So, a reduction in the frequency of surgical flow disruptions through the use of a preoperative briefing can diminish surgical error and adverse outcomes in the operating room.

Our pilot work demonstrated that such a specialty-specific briefing can be created and implemented in a short period of time and can lead to a dramatic reduction in surgical flow disruptions. We advocate for collaborative conduct of the briefing by surgical team members to enhance communication, encourage staff engagement, and foster an environment in which individuals are more likely to speak up when concerned or during adverse events.

Our efforts to design and implement a specialty-specific preoperative briefing in cardiovascular surgery coincide with those from other studies that have instituted similar measures in ICU and emergency department operating rooms.[21,22] The reduction in miscommunication events observed in these studies after implementation of a briefing corroborates with our findings. Distinct from these previous studies, however, is our categorical assessment of surgical flow disruptions and our evaluation of circulating nurse trips to the core. We observed a marked decrease in both after use of the briefing, and we specifically noted drastic reductions in patient, procedural, and equipment-related flow disruptions. To our knowledge, this is the only study to date that has used real-time observations and specific observable behavioral markers (ie, circulating nurse exiting the room) to assess the effect of a preoperative briefing on specific forms of surgical flow disruptions.

During the briefing-design process, each discipline comprising the surgical team thought that the briefing should cover more information pertinent to their specific surgical tasks and consequentially, place less emphasis on the tasks of others. Accordingly, there was variation between disciplines pertaining to what information should be exchanged during the preoperative briefing. For example, perfusionists indicated that cooling temperature and desired blood pressure were important information to exchange; certified surgical assistants sought information on the position and desired length of vein to take. Such input from all team members about briefing content ensured that the briefing was truly designed for the team, rather than for a single member of the team. Designing a briefing with only a single team member in mind could have resulted in much narrower briefing content and not adequately addressing the needs of the surgical team. We believe that the range of critical information necessary to include in a preoperative briefing can be best acquired using a collaborative approach.

Previous studies have demonstrated that information exchanged in the operating room is done so in an ad-hoc, tense manner that does not foster a comfortable, communication-friendly environment.[23] Our preoperative briefing formalized information transfer of critical information among the operating room team members, creating an opportunity for questions and concerns for every team member. We believe that this is the primary reason that there was a significant reduction in procedural knowledge disruptions after implementation of the briefing.

Additionally, our findings demonstrated that briefed groups had appreciably fewer miscommunication events. This is consistent with results from previous studies, which demonstrated that preoperative briefings that highlight the main issues of patient and operative procedures result in fewer communication failures.[7] We believe this is because of the functional impact of establishing open dialog before a case, which, consequentially, continues throughout the case. It is essential that each team member is thinking crit-

Table 4. Average Number of Trips to the Core per Surgical Case by Circulating Nurse in Preimplementation Versus Postimplementation Group

	Preimplementation group	Postimplementation group	Decrease, %	p Value
Trips to core (per case), n	10	4.7	53	0.008
Time spent in core per case, min	6.6	2.9	56	0.01

ically about possible risks from the beginning to the end of a case, otherwise, the team can quickly become disengaged and miss subtle migrations toward error during a procedure.[24] In this regard, our briefing format goes beyond a basic checklist, which may be effective in identifying predictable errors but cannot account for the unexpected. In an activity like cardiovascular surgery, a checklist will not cover all aspects of the complexity of the case. A briefing can enable a team to manage error proactively through a shared mental model because the team is engaged, aware, and sharing information from the beginning of the procedure.

We believe that the participatory format of our briefing promoted more mindful engagement of the staff. In an analysis of the institution of checklists, Lingard and colleagues[25] observed that they were most effective when the leader invited participation. By establishing a structure that demands participation of all surgical team members, we have reduced the impact of any individual leader's "style." The value of briefings appears to us to be both informational and functional.[26] In addition to "informational utility" with explicit confirmation, reminders, education, or facts surrounding a case, there is a "functional utility" that arises from personal interaction and that promotes identifying problems, prompting decision-making, and provoking followup actions.

Although this pilot implementation of the briefing was successful, many cultural barriers impeded our ability to institute the briefing protocol across all operating room suites. The logistics of determining an appropriate time to hold the briefing, and a way to ensure that all team members are able to participate remains challenging.[27] The positive results shown here are the result of a very deliberately designed protocol. Successful protocol design was driven by integration of staff feedback at all stages of the design and implementation process.

There are significant limitations to our study. First, in the pilot, the briefing was used only in the first case of the day and only in one operating room. This was a deliberate choice in our methodologic design to determine the feasibility of the preoperative briefing before use in other operating rooms and for other cases. Logistical and cultural barriers limited the breadth of our study as noted earlier. Preliminary data from a different hospital showed a similar reduction in surgical flow disruptions and circulating nurse trips to the core through replication of the methodology used in the design and implementation of our briefing (Jill Garrett, personal communication).

Second, the "trained observer" was a medical student (RW) with only limited clinical experience. Although he had spent considerable time in the cardiac surgical operating rooms and was mentored by a senior cardiac surgeon (TMS), he was still not truly a "subject matter expert." Although the limitations inherent to this are obvious, there is also an advantage to using an observer who has not yet become inured to errors that clinicians may overlook and perceive as "normal." Finally, the observer was not blinded to whether teams had been briefed or not. Ideally, videotapes would be collected and analyzed in a blinded and time-scrambled manner. But this technology is not currently available in our operating room, and recording such tapes poses significant challenges with regard to confidentiality and liability. Finally, a relatively small number of cases were observed. Despite this, several end points achieved statistical significance.

The results of this pilot study demonstrate that development and institution of a specialty-specific briefing is feasible and has the potential to diminish surgical flow disruptions.

Author Contributions

Study conception and design: Henrickson, Wiegmann
Acquisition of data: Henrickson, Wadhera
Analysis and interpretation of data: Henrickson, Wadhera, ElBardissi, Wiegmann, Sundt
Drafting of manuscript: Henrickson, Wadhera, ElBardissi
Critical revision: Henrickson, Wadhera, ElBardissi, Wiegmann, Sundt

REFERENCES

1. Weick K, Sutcliffe K. Managing the unexpected: assuring high performance in an age of complexity. 1st ed. San Francisco: John Wiley & Sons; 2001.
2. Organizations JCoAoH. Sentinel event statistics. Vol. 2007. Oakbrook Terrace, IL: The Joint Commission; 2007.
3. Gawande AA, Zinner MJ, Studdert DM, Brennan TA. Analysis of errors reported by surgeons at three teaching hospitals. Surgery 2003;133:614–621.
4. Lingard L, Espin S, Whyte S, et al. Communication failures in the operating room: an observational classification of recurrent types and effects. Qual Saf Health Care 2004;13:330–334.
5. DeFontes J, Surbida S. Preoperative Safety Briefing Project. Perm Found Med Bull 2004;21–27.
6. Catchpole KR, Giddings AE, Wilkinson M, et al. Improving patient safety by identifying latent failures in successful operations. Surgery 2007;142:102–110.
7. Makary MA, Mukherjee A, Sexton JB, et al. Operating room briefings and wrong-site surgery. J Am Coll Surg 2007;204:236–243.
8. Lingard L, Regehr G, Orser B, et al. Evaluation of a preoperative checklist and team briefing among surgeons, nurses, and anesthesiologists to reduce failures in communication. Arch Surg 2008;143:12–17; discussion 18.
9. Altpeter T, Luckhardt K, Lewis JN, et al. Expanded surgical time out: A key to real-time data collection and quality improvement. J Am Coll Surg 2007;204:527–532.

10. The Lancet. WHO's patient-safety checklist for surgery. Lancet 2008;372:1.
11. Awad SS, Fagan SP, Bellows C, et al. Bridging the communication gap in the operating room with medical team training. Am J Surg 2005;190:770–774.
12. ElBardissi AW, Wiegmann DA, Dearani JA, et al. Application of the human factors analysis and classification system methodology to the cardiovascular surgery operating room. Ann Thorac Surg 2007;83:1412–1418, discussion 1418–1419.
13. Wiegmann DA, ElBardissi AW, Dearani JA, et al. Disruptions in surgical flow and their relationship to surgical errors: an exploratory investigation. Surgery 2007;142:658–665.
14. ElBardissi AW, Wiegmann D, Henrickson S, et al. Identifying methods to improve heart surgery: an operative approach and strategy for implementation on an organizational level. Eur J Cardiothorac Surg 2008;34:1027–1033.
15. Catchpole KR, de Leval MR, McEwan A, et al. Patient handover from surgery to intensive care: using Formula 1 pit-stop and aviation models to improve safety and quality. Paediatr Anaesth 2007;17:470–478.
16. Berg B. Qualitative research methods for the social sciences, 6th ed. Boston, MA: Allyn and Bacon; 2007.
17. Carthey J, de Leval MR, Reason JT. The human factor in cardiac surgery: errors and near misses in a high technology medical domain. Ann Thorac Surg 2001;72:300–305.
18. Wong DR, Torchiana DF, Vadner Salm TJ, et al. Impact of cardiac intraoperative precursor events on adverse outcomes. Surgery 2007;141:715–722.
19. Likosky DS, Leavitt BJ, Marrin CA, et al. Intra- and postoperative predictors of stroke after coronary artery bypass grafting. Ann Thorac Surg 2003;76:428–434, discussion 435.
20. Dacey LJ, Likosky DS, Leavitt BJ, et al. Perioperative stroke and long-term survival after coronary bypass graft surgery. Ann Thorac Surg 2005;79:532–536, discussion 537.
21. Pronovost P, Berenholtz S, Dorman T, et al. Improving communication in the ICU using daily goals. J Crit Care 2003;18:71–75.
22. Morey JC, Simon R, Jay GD, et al. Error reduction and performance improvement in the emergency department through formal teamwork training: evaluation results of the MedTeams project. Health Serv Res 2002;37:1553–1581.
23. Lingard L, Reznick R, Espin S, et al. Team communications in the operating room: talk patterns, sites of tension, and implications for novices. Acad Med 2002;77:232–237.
24. Amalberti R. The paradoxes of almost totally safe transportation systems. Safety Science 2001;37:109–126.
25. Lingard L, Whyte S, Espin S, et al. Towards safer interprofessional communication: constructing a model of "utility" from preoperative team briefings. J Interprof Care 2006;20:471–483.
26. Lingard L, Espin S, Rubin B, et al. Getting teams to talk: development and pilot implementation of a checklist to promote interprofessional communication in the OR. Qual Saf Health Care 2005;14:340–346.
27. Campbell M, Fitzpatrick R, Haines Kinmonth AL, et al. Framework for design and evaluation of complex interventions to improve health. BMJ 2000;321:694–696.