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Deconstructing intraoperative communication failures

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Abstract

Background—Communication failure is a common contributor to adverse events. We sought to characterize communication failures during complex operations.

Methods—We video recorded and transcribed six complex operations, representing 22 h of patient care. For each communication event, we determined the participants and the content discussed. Failures were classified into four types: audience (key individuals missing), purpose (issue nonresolution), content (insufficient/inaccurate information), and/or occasion (futile timing). We added a systems category to reflect communication occurring at the organizational level. The impact of each identified failure was described.

Results—We observed communication failures in every case (mean 29, median 28, range 13–48), at a rate of one every 8 min. Cross-disciplinary exchanges resulted in failure nearly twice as often as intradisciplinary ones. Discussions about or mandated by hospital policy (20%), personnel (18%), or other patient care (17%) were most error prone. Audience and purpose each accounted for >40% of failures. A substantial proportion (26%) reflected flawed systems for communication, particularly those for disseminating policy (29% of system failures), coordinating personnel (27%), and conveying the procedure planned (27%) or the equipment needed (24%). In 81% of failures, inefficiency (extraneous discussion and/or work) resulted. Resource waste (19%) and work-arounds (13%) also were frequently seen.

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Conclusions—During complex operations, communication failures occur frequently and lead to inefficiency. Prevention may be achieved by improving synchronous, cross-disciplinary communication. The rate of failure during discussions about/mandated by policy highlights the need for carefully designed standardized interventions. System-level support for asynchronous perioperative communication may streamline operating room coordination and preparation efforts.

Keywords

Team communication; System communication; Communication failures; Intraoperative video

1. Introduction

Communication is critical to the safe delivery of surgical care. The Joint Commission attributes 56% of operative or postoperative complications to faulty communication [1]. Problematic behavior lie at the root of 78% of surgical malpractice claims, and among these, the failure to communicate is the most common, accounting for 22% of complications [2].

In the operating room (OR), a high degree of coordination between individuals and teams is required. Such teamwork necessitates effective communication. Multiple studies have alluded to the importance of communication in the OR. One review of surgical malpractice claims found that nearly a third of communication breakdowns occurred in the OR [3]. Nationally, hospitals in which physician communication is rated highly by surgical staff members have demonstrated lower risk-adjusted morbidity [4]. In one field observation study, patients were observed to have an increased odds of complications or death when intraoperative information sharing was low [5].

Although progress in the study of intraoperative communication has been made, the specific characteristics that predispose it to or safeguard it from failure have yet to be completely described. Lingard *et al.* [6,7] developed and validated an instrument for evaluating team communication in the OR, but because her team did not observe procedures in their entirety, her findings may not truly represent intraoperative communication as a whole. Halverson *et al.* [8] expanded this instrument to capture discussion content but used it to study failures alone, disregarding all other intraoperative communications. Indeed, although the instrument defines broad categories for describing communication in the OR, it has yet to be applied to determine how various failures and their sequelae are influenced by the participants, their discipline, the timing of the communication, and its content. This manuscript will attempt to address these gaps.

Finally, this instrument has thus far only been used during live observations, a methodology limited by the transient and complex nature of OR interactions. Because it relies on humans to observe and process multiple, often simultaneous, conversations and occurrences, its reproducibility is a concern. Thus, we sought to apply Lingard's instrument to characterize intraoperative communication in complex operations captured on video.

2. Materials and methods

Six complex, high-acuity surgical procedures, representing 22 h of intraoperative time, were audio- and video recorded from nursing setup through patient exit. This study summarizes the results of a single project within a larger parent study of intraoperative safety and performance. The data collection procedures have been previously described [9]. Transcripts of the videos were generated by two surgical research fellows (YYH and AFA) using remote analysis of team environments, open access software developed by Guerlain *et al.* [10] to play multiple audio and video streams in synchrony. These transcripts were then reviewed by a multidisciplinary panel consisting of the surgeon-principal investigator, a cognitive psychologist, and an educational psychologist.

Two coders (YYH and CCG) reviewed the transcripts. We defined a communication event as a verbal exchange between two or more team members with a unique communicative intent or theme that occurred at a specific point in time. We differentiated between two intertwined conversations and a second conversation about the same topic. For example, if an anesthesiologist had a conversation with a nurse about the supplies he needed and taught his resident about intubation technique in the pauses in that conversation, we called these two separate, but ongoing, communication events, rather than defining each restart of the conversation as a separate event. Alternatively, if the anesthesia team and the surgical resident had a conversation about the patient status, then dropped the subject and began discussing hospital policy, then later returned to the conversation about patient status, we called these three communication events—two about patient status and one about policy. This differentiation was aided by two metrics: 1) the time elapsed between spoken statements (i.e., with shorter intervals corresponding to a single, but interrupted, conversation and longer intervals corresponding to separate conversations with repeated content) and 2) the nature of the intervening content (e.g., in the first example, two conversations with two different people were going on but within each, the discussion topic remained the same, whereas in the second, the participants remained the same and changed their topic of discussion twice). We limited the study to communication between members of the OR team and did not include communication events in which the patient was a participant.

For each communication event, the coders identified the participants involved (surgery, anesthesia, or nursing) and the timing with regard to case progress (nursing setup, patient in-room time, incision through closure time, and postoperative time). Using a classification schema developed by Halverson *et al.* [8], we characterized the content discussed in each event: equipment, progress report (updates on progress or patient status), medications, procedure (details pertaining to the operation), personnel, policy, and other. We adapted their “policy” category to include communication about hospital/OR policy (e.g., discussion about difficulty with documentation), as well as those mandated by hospital/OR policy (e.g., communication related to counting activities or time-outs). We divided their “other” category into “other patient care” and “chitchat.” Using the instrument developed and validated by Lingard *et al.* [6,7], we classified communication failures: audience (the exclusion of key individuals from a conversation), content (insufficient or inaccurate information), occasion (a discussion rendered futile by timing), and/or purpose (the failure to resolve a discussed issue). We added a systems category to reflect communication that occurs at the organizational level. Lingard's instrument also was used to describe the impact of each identified failure: no visible effect, inefficiency, team tension, delay, work-around, resource waste, patient inconvenience (e.g., delays or extraneous laboratory draws while the patient was conscious), and/or procedural error. To this classification, we added a potential/ actual adverse event category. Codes were finalized by discussion and consensus, as described by both Lingard *et al.* [6] and Halverson *et al.* [8].

We calculated the frequencies with which communication failures and their subtypes occur. We then calculated the relative frequency of failure given the involvement of the different subteams and the content discussed. We also calculated the frequency with which failures resulted in various impacts. Finally, we assessed for bivariate associations between the participants involved and failure types observed, as well as between the content of the discussion and the impact of the failure, using chi-square test.

3. Results

Case descriptions are shown in Table 1. In 22 h of video (18 of which were patient-in-room time), we observed a total of 1936 communication events. Of these, 8.7% failed. On average, each case had 28 failures (median 26.5, range 11–47), computing to a rate of 1 every 7.7 min or 7.7/h.

3.1. Participants

Almost half (48.1%) of all communication events were initiated by the surgeons, whereas 30.5% and 19.1% were initiated by the nursing and anesthesiology teams, respectively. Communication was most commonly directed at nurses (44.1%), followed by surgeons (29.5%) and anesthesiologists (20.9%). Failure most frequently resulted from nursing-initiated or anesthesiology-directed communication: 11.2% of nursing-initiated events failed, as did 10.8% of anesthesiology-directed ones. Communication between the surgery, anesthesia, and nursing disciplines resulted in failure (11.2%) nearly twice as often as communication within a single discipline (6.1%). Of all communication failures, most (64.3%) were cross-disciplinary; 36.3% were intradisciplinary.

3.2. Timing

Most failures occurred between incision and closure (54.2%); however, the size of this proportion merely represents the amount of time spent in this phase. When expressed as a percentage of communication events, the rate of failure was actually lowest in this phase; between incision and closure, only 7.2% of communication events failed. The highest rate of failure (16.1% of events) occurred during nursing setup, primarily reflecting uncertainty about the procedure and requisite supplies. The rates of failure were only 9.5% between patient entry and incision and 9.8% postoperatively.

3.3. Content

Discussions about or mandated by hospital policy, as well as those regarding personnel or other patient care were most error prone; 20.7%, 17.6%, and 15.6% of communication events about these topics failed, respectively. The exhaustive list of discussion content and failure rates can be found in Table 2. The following example demonstrates the degree to which policy-mandated communication may confuse, rather than aid, those for whom it is enacted:

Circulator: What should I put in (the OR log) for anesthesia start time? We came in (to the OR) at 9:46.

Anesthesia attending: You know, I'm not 100% sure what that means to you guys.

Circulator: I don't know.

3.4. Failure types

The classification of failures is shown in Table 3. Audience and purpose each accounted for more than a third of failures. Both were particularly common during setup; we observed multiple conversations between (and within) nursing, anesthesiology, and surgery resident about the surgical attending's preferences, for example, regarding antibiotics, subcutaneous heparin, and equipment. Without the key person—the surgical attending—present (audience), the questions often went unanswered (purpose). For example,

Circulator: Do you want the extender or not?

Scrub: I don't know. I don't work with (attending) enough to know.

Over a quarter of failures were caused by flawed systems for communication. Among system-level communications, those concerning the dissemination of policy (28.3%), personnel (26.1%), equipment (21.7%), and procedure (17.4%) were particularly prone to failure.

In one scenario, more surgical oncology cases were booked than the OR had oncology kits to supply or oncology nurses to staff. Thus, the nurses in our case were required to assemble an *ad hoc* oncology kit by taking pieces from other kits, a work-around made even more inefficient by the assigned nurses' unfamiliarity with the needed equipment. If a mechanism existed to book cases according to available resources, this unnecessary work would have been avoided.

We repeatedly observed instances in which laboratory tests that had been drawn in preadmission testing returned with abnormal results but were not checked until the patient reached preoperative holding. Because there was no systematic way for the appropriate clinicians to be alerted to problematic results, these cases were delayed while further investigation was performed. Additionally, because of the lack of a system of communication between the anesthesiologists in preoperative holding and the nurses in the OR, the OR was unaware of the delay. In one case, the abnormal result was a positive pregnancy test, which was ultimately found to belong to another patient. When the anesthesiology team brought the patient into the room, the circulator asked:

Nurse: What do you want me to put as reason for delay?

Anesthesia resident: Delay?

> *Patient:* I think the right hand and the left hand work (separately)…I was pretty confident I wasn't pregnant. I had been traveling a lot.

Content contributed to 18.0% of communication failures. In one case, the scrub technician left the OR without telling anyone where he was going or how long he would be gone. During induction, the pod nurse entered the room by chance, discovered his absence, and, after several futile discussions with the circulator, scrubbed in his place. As another nurse had to be pulled into the room to cover, this content failure led to inefficiency, resource waste, and a work-around. It also could have been the source of a delay, had the pod nurse not fortuitously entered the room in time to scrub the case.

Occasion contributed to 20.5% of failures. In one case, the surgical attending asked the surgical resident if he or she had given the patient subcutaneous heparin 53 min after incision. If heparin had not already been administered, the timing of this cross-check would have been too late.

3.5. Failure impact

As seen in Table 4, 88.7% of all failures had an impact on flow or safety of the operation. In 79.2% of failures, inefficiency resulted. Resource waste (18.5%) and work-arounds (13.7%) also were commonly observed. A smaller, but substantial, proportion of failures precipitated team tension (9.5%), procedural errors (8.3%), and delays (8.9%).

3.6. Bivariate associations

Communications that resulted in audience (44.1%) failures were most commonly initiated by nurses (*versus* anesthesiologists and surgeons 11.8%–17.7%, $P = 0.0033$). Content (34.2%) and systems failures (52.2%) most frequently originated from people external to the OR (*versus* surgeons, nurses, and anesthesiologists 10.9%–23.9%, $P < 0.0001$ and 17.1%–24.4%, $P = 0.0002$, respectively). Occasion failures tended to occur during communications directed at surgeons (32.4% *versus* anesthesiologists and nurses 27.0%–29.7%, $P = 0.021$). System failures were generally noted during communications directed at nurses (34.8%) or anesthesiologists (26.1%), compared with surgeons (13.0%, $P = 0.015$).

Communication failures about the procedure were associated with patient inconvenience ($P = 0.003$). Failures in conversations regarding personnel were correlated with resource waste ($P = 0.002$) and work-arounds ($P < 0.0001$).

4. Discussion

During complex operations, communication failures occur frequently. Our percentage of communication events that failed was just under 10%, a figure substantially lower than the 30.6% reported by Lingard *et al.* [6]. However, her team did not evaluate operations in their entirety; her observers were only present for the most failure-prone portions of an operation (i.e., the room setup and the induction) and therefore missed those segments of the operation that are less communication intense. Our communication failures were more likely to have sequelae for the case (89% *versus* 36%) suggesting that we may not have captured less significant communications as were documented by Lingard *et al.* There are limits to the ability of any human observer to accurately capture the true denominator of communication events or the totality of their up- and downstream effects when many occur simultaneously. Thus, we built on Lingard's work by video recording operations from start to finish. As a result of having generated an audio–video record, followed by a transcript, we were able to repeatedly and iteratively review the data until we were confident that all communication events and failures were accurately counted. Nevertheless, the rate of failure as a function of time was impressive; on average, there was a communication failure every 7–8 min. As almost 90% of communication failures impacted the case, it is important to understand how these failures occur.

Failures tended to occur with cross-disciplinary exchanges. Additionally, the most common types of failure involved audience (absence of a key person) and purpose (failure to resolve a discussed issue)—the latter often as a result of the former. Prevention may be attempted by improving synchronous, cross-disciplinary communication, as suggested by the low rate of failure during incision time, when all three teams are simultaneously present in the OR. We saw a great deal of preoperative uncertainty that could have been easily resolved by conducting a brief conversation with the attending surgeon.

Preoperative briefings and checklists have been shown to reduce communication failures [11], delays [12], and morbidity and mortality [13]. The Surgical Safety Checklist is in routine use in our hospital (which we confirmed in all of our cases), but we observed cross-disciplinary communication failures nonetheless. One idea for improving communication might be to expand the Checklist to address these issues of preoperative uncertainty; however, we have several concerns about this approach. First, the Checklist does not begin until after preoperative setup has concluded; it begins after the patient has entered the room, when those present are busy coordinating and performing induction. Second, the attending surgeon is often not present for this portion of the Checklist; the surgeon's portion of the Checklist does not occur until immediately before incision, when it is too late for the nurses or the anesthesiologists to use the information to prepare for the case—they have only time to react. Finally, we believe that the power of the Checklist lies in its brevity and broad applicability. An exhaustive Checklist that varies with each case may be so cognitively burdensome that compliance, and therefore effectiveness, would drop. We have previously reported on the existence of disabling protocols [14]. Any intervention, especially one based on expansion of the Checklist, must be carefully evaluated not only to determine effectiveness, but also to identify any unintended negative consequences. We suggest that much preoperative uncertainty may be resolved less formally, with a quick (<2 min) attending visit or a phone call during setup (before patient entry).

Given the rate of failure during discussions about or mandated by hospital policy, we advocate for careful design, dissemination, and evaluation of standardized interventions. We have previously published about the unintended consequences of new protocols: although an intervention may successfully achieve its intended goal, it may also have negative side effects that must be considered [14]. In our study, we watched as OR staff members expressed confusion about protocols and voiced valid concerns about their (often detrimental) impact on work flow. Clearly, a mechanism for improving communication between the frontline providers and the administration also is needed.

Indeed, system-level failures were common. The current methods for communicating beyond the level of the individual OR are suboptimal. An improved communication system may circumvent many of the failed discussions we observed about personnel or other patient care, as well as relay information between OR staff and hospital decision makers. For example, OR nursing could potentially benefit from a shared online staff scheduling system —one that can be checked and updated from inside every OR, thus providing advanced warning of when relief will be arriving and obviating the need for multiple person-to-person conversations to coordinate breaks. We heard the nurses' (and surgeons') frustrations with the current system, in which individual nurses arrive to relieve others for breaks at unpredictable times that depend on the staffing (and progress) of other ORs. When more optimally timed, hand-offs may become less vulnerable to information loss [15]. An asynchronous system for communication may also help streamline OR preparation efforts, specifically with regard to equipment or medication procurement.

4.1. Limitations

Because this was an observational study, the Hawthorne effect was of some concern. By using video (with equipment placed unobtrusively throughout the room), we believe that we minimized this effect, especially in comparison with methodologies employing live observers in the OR. The operations we recorded were generally long and complex, and we found that the teams became so engaged in their work that they forgot about the recording (as evidenced by the confidential nature of their discussions). We therefore believe our video capture is naturalistic; however, if not, then our estimate of communication failure is more likely to be an underestimate.

As our study was conducted at a single academic institution, generalizability may also be limited. Our rate of failure, expressed as a percent of communication events, is smaller than that reported by Lingard *et al.* [6]. The distribution of failure types is dissimilar to both Lingard *et al.* and Halverson *et al.* [8]; however, those reports differ from one another, as well. Such discrepancies may be those reports differ underlying communication and/or cultural differences between institutions or, alternatively, differences in methodology. Lingard *et al.* did not view operations in their entirety, as we did. Halverson *et al.* assigned only one type to each failure; for her team, the types were mutually exclusive, although for Lingard *et al.* (and for us), they were not. Likewise, the distribution of the consequences of failure differed and again, may reflect institutional factors or study methodology. Unlike Lingard *et al.* or Halverson *et al.*, we selected complicated cases, which may have higher stakes for error.

In high-acuity operations, communications occur frequently and lead to inefficiency. We provide important information about the characteristics of communication failure in this setting. This data should be used to inform the design of future interventions aimed at improving communication, whether between operative team members in a single individual OR or between populations of people working throughout an OR system and its parent hospital.

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Table 1

Cases and communication failures.

Case	Scheduled duration (min)	Actual duration (min)	Number of communication events	Number of communication failures (% of events)
1	350	291	571	47 (8.2)
2	150	118	286	11 (3.8)
3	230	263	354	28 (7.9)
4	240	185	286	22 (7.7)
5	230	146	217	25 (11.5)
6	180	78	222	35 (15.8)
Total	1380	1081*	1936	168 (8.7)

*Actual duration represents the amount of time the patient was in the room.

Table 2

Discussion content of communication failures.

Discussion topic	Number of communication events	Number of communication failures (% of events)
Chitchat	95	–
Equipment	743	61 (8.2)
Environment	55	4 (7.3)
Medications	140	15 (10.7)
Other patients	90	14 (15.6)
Personnel	108	19 (17.6)
Policy	116	24 (20.7)
Procedure	632	42 (6.7)
Progress report	255	14 (5.5)

Note: Discussion topics are not mutually exclusive.

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Table 3

Classification of communication failures.

Failure type	Number of failures	Percent of failures
Audience	42	34.4
Content	22	18.0
Occasion	25	20.5
Purpose	56	45.9
Systems	46	27.4

Note: Failure types are not mutually exclusive.

Table 4

Impact of communication failures.

Impact	Number of failures	Percent of failures
None	19	11.3
Delay	15	8.9
Inefficiency	133	79.2
Patient inconvenience	10	6.0
Potential/actual adverse event	2	1.2
Procedural error	14	8.3
Resource waste	31	18.5
Team tension	16	9.5
Work-around	23	13.7

Note: Impact types are not mutually exclusive.