Supplementary Appendix for Manuscript: Closing the gap between principle and reality: A mixed-methods study on critical event debriefing

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Additional methods from meeting with the Quality Improvement(QI)/Patient Safety team of the department, as well as institutional Risk Management:

The project was formally presented at a Quality and Safety Oversight Committee meeting to designate it as a Quality and Safety project that would grant it peer-review protection/privileges. In addition, data were collected in such a way as to minimize identifiers. While the study was IRB approved to collect medical record numbers and date/times of the events, the decision was made to remove these items from the data collection. Residents and other study participants were asked not to provide names or identifiers. If this information was volunteered by the resident or other study participant, it was either not entered or destroyed during data review. Once the audio-recordings were transcribed, de-identified, and no longer needed in the research context, they were destroyed.

List of events shown to study participants to query for critical events:

**Did any of the following events happen to you/your call team during your call?**

|  |  |
| --- | --- |
| **Event** | **Y / N** |
| Cardiac arrest |  |
| Massive hemorrhage[[1]](#footnote-1) |  |
| Malignant hyperthermia |  |
| Period of significant or prolonged hypotension and/or hypoxemia |  |
| Unstable tachycardia or bradycardia for a non-cardiac case |  |
| Anaphylaxis |  |
| Local anesthetic toxicity |  |
| Transfusion reaction with hemodynamic changes or other significant signs/symptoms |  |
| High spinal |  |
| Air embolism, amniotic fluid embolism, CO2 embolism, fat embolism, or other suspected embolic event |  |
| Medication error |  |
| Operating room fire |  |
| Urgent need for a surgical airway |  |
| Anesthesia machine/other mechanical failure that may have caused patient harm or came near to causing patient harm |  |
| Inadvertent/preventable event that may have caused patient harm or came near to causing patient harm |  |
| Multiple, possibly smaller events, with close temporal relation such that resources and/or staffing were limited/stretched |  |
| Occurrence of disruptive behavior, difficult personality, or other demonstration from a staff member that undermined a culture of teamwork/safety |  |
| An event for which an individual involved in the case desired/requested a debriefing |  |
| Other event (such as the calling of an anesthesia-stat or event similar to those described above) |  |

Additional details on data collection methods:

Research assistants (RES, MM) served as data collectors and were introduced to the residents and members of the department by the Departmental Chair. The data collectors made themselves available in several ways. They emailed residents during their overnight shifts and/or called/paged them shortly after their overnight shifts were completed. The data collectors were also present at handoffs between day and night shifts (e.g., airway resident) for both the main operating room and the obstetric anesthesia team. The data collectors also sat with the post-anesthesia care unit (PACU) resident on weekday afternoons to be available for residents who were dropping off patients. Snowball sampling was also used to identify events (i.e. if a resident/staff identified an event, they were asked if they knew of anyone else who recently experienced a critical event).

Additional information on the data collectors/reviewers:

RES is a medical student and RB is an MD/PhD student in Anthropology (at the study start, they held a similar position to MM, who is a full-time research assistant at the study institution). JTC is an PhD/MPH medical/linguistic anthropologist with extensive experience in the social sciences.1,2 AFA is an MD/MPH/ScD attending anesthesiologist with extensive experience in the study and development of evidence-based solutions to reduce malpractice risk and improve patient safety.2-7

**References:**

1. Clapp JT, Gordon EKB, Baranov DY, Trey B, Tilin FJ, Fleisher LA: Encouraging Reflexivity in a Residency Leadership Development Program: Expanding Outside the Competency Approach. Acad Med 2018; 93: 210-213.
2. Clapp JT, Arriaga AF, Murthy S, Raper SE, Schwartz JS, Barg FK, Fleisher LA: Surgical Consultation as Social Process: Implications for Shared Decision Making. Ann Surg 2017.
3. Arriaga AF, Bader AM, Wong JM, Lipsitz SR, Berry WR, Ziewacz JE, Hepner DL, Boorman DJ, Pozner CN, Smink DS, Gawande AA: Simulation-based trial of surgical-crisis checklists. N Engl J Med 2013; 368: 246-53.
4. Hu YY, Arriaga AF, Peyre SE, Corso KA, Roth EM, Greenberg CC: Deconstructing intraoperative communication failures. J Surg Res 2012; 177: 37-42.
5. Arriaga AF, Elbardissi AW, Regenbogen SE, Greenberg CC, Berry WR, Lipsitz S, Moorman D, Kasser J, Warshaw AL, Zinner MJ, Gawande AA: A policy-based intervention for the reduction of communication breakdowns in inpatient surgical care: results from a Harvard surgical safety collaborative. Ann Surg 2011; 253: 849-54.
6. Hu YY, Arriaga AF, Roth EM, Peyre SE, Corso KA, Swanson RS, Osteen RT, Schmitt P, Bader AM, Zinner MJ, Greenberg CC: Protecting patients from an unsafe system: the etiology and recovery of intraoperative deviations in care. Ann Surg 2012; 256: 203-10.
7. Arriaga AF, Gawande AA, Raemer DB, Jones DB, Smink DS, Weinstock P, Dwyer K, Lipsitz SR, Peyre S, Pawlowski JB, Muret-Wagstaff S, Gee D, Gordon JA, Cooper JB, Berry WR, Harvard Surgical Safety C: Pilot testing of a model for insurer-driven, large-scale multicenter simulation training for operating room teams. Ann Surg 2014; 259: 403-10.

Additional details on the qualitative coding process:

An open coding process was first undertaken in which the same set of 3 interview transcripts was annotated by RES, MM, and RB to derive prominent themes. These themes were formalized into a taxonomy (codebook). This codebook was then used for two rounds of double coding. In each of these rounds, RES and MM double coded 3 transcripts, while RES and RB double coded a different set of 3 transcripts; codes were compared for reliability, all discrepancies were revised through discussion and consensus, and the codebook was revised to address any gaps and modify any categories lacking clarity or utility. Equipped with a refined codebook and group consensus on its application, RES then coded the remaining transcripts. Theory development was ongoing throughout this process via group discussion.

Expanded Results section on Qualitative Findings:

 We analyzed 25 events associated with 26 semi-structured interviews (Figure 1). The interviews lent additional detail to the quantitative findings. Residents described a range of lapses in effective communication. These lapses were often described as incurring communicative sequelae that persisted beyond the event.

Many residents related “stressful” or “confusing” circumstances born out of contradictory directives. Conflicting clinical opinions and approaches were reported as coming both from anesthesia/faculty and residents, as well as other providers. For instance, this resident reports being given mutually exclusive directives from the surgery and anesthesia teams during a code, an occurrence attributed to an ambiguous decision-making hierarchy:

INTERVIEWER: [W]as anyone giving clear directives, or was there someone running the code?

ANESTHESIA RESIDENT (R): Unfortunately no. It was very disorganized […]. It wasn’t very clear who was in charge at that moment. And communication was very poor. On one hand the surgical team was saying don’t do compressions. And then we were saying to do compressions.

In other accounts, anesthesia attendings had “different opinions on what could’ve been done with the airway.” While residents acknowledged that tracheal intubation could be accomplished in multiple ways, they noted the frustration and confusion that can be inherent when the clinical scenario is complex. One resident detailed a particularly severe example:

R: [T]here was a lot of miscommunication between the teams. I think that between our team as anesthesia providers, we all didn’t listen to each other. I think the attending felt offended because a resident pretty much overruled him in front of everyone. And then, the resident felt like she was in a bad spot […]. She really wanted to do what’s best for the patient….it was a huge disagreement between the resident and the attending.

Here, the resident quoted was a bystander in this disagreement. The resident described the attending as having “tunnel vision,” “not receptive at all” to a different opinion. Of note, the resident reports that the input of the medical ICU attending and an otherwise uninvolved cardiac anesthesiologist (via phone) were obtained prior to induction, but there was not a clear consensus across the attendings, given the patient’s medical complexity. When the patient’s urgency progressed to extremis during the airway attempt, yet another attending (cardiac ICU attending anesthesiologist) was immediately called and arrived, agreed with the resident, and this option was chosen.

Residents also expressed frustration about instances in which seemingly basic communication issues, such as the ability to successfully contact providers during emergency situations, negatively impacted the team’s ability to solve problems. One anesthesia resident explained that during a protracted crisis event they “called people in [i.e. home-call cardiac attending anesthesiologist and home-call anesthesia resident rotating on cardiac], which was a mess because […] the [phone call attempt to the home-call] cardiac attending went to voicemail.” This resident subsequently called the wrong home-call anesthesia resident based on a misreading of the schedule [of note, phone call, and not paging, was the routine method of communication for the clinical scenario in question at the study institution]. This particular scenario served as prelude to further downstream miscommunication:

R: And there was miscommunication, as there often is. I tried to mention to her [the cardiac nurse] that I had, in fact, called the cardiac [anesthesia] attending, but had not gotten in touch with her and left a voicemail. And then, I overheard her [the cardiac nurse] on the phone saying that we talked to cardiac anesthesiology. So I said to her [the cardiac nurse], I was like, sorry. Maybe you misunderstood me. And I think – I just think that message kept getting not heard…[later in the passage]…and he [the cardiac surgical fellow] was furious that cardiac anesthesia was not there…he kept saying, if anything happens, it’s on you guys, which is not helpful.

Another interviewee described a crisis during which they “tried calling the attending of record [who] said that they were too busy.” The resident recounted their urgency in contacting the attending, saying that they were feeling overwhelmed by the situation and “needed [the attending] to come down here.” The resident reported that the attending of record did not appear until “some point during the code,” and instead sent another anesthesiologist, and then signed the case out to this anesthesiologist. While the competing priorit(ies) of the first attending were unclear, the second attending stayed closely involved during the resuscitation.

Additionally, interviewees emphasized the simple challenge of hearing and understanding colleagues during a code and in turn generating clear responses. The inability to communicate due to the hectic nature of codes arose in several resident interviews. With “lots of people yelling” and no “sense that there was a code leader,” residents sometimes found it nearly impossible to effectively communicate with colleagues, as exemplified by these two separate accounts:

R: I think it was so chaotic and people were – orders were coming from everywhere. One person over in the corner was saying something. […] [Someone] over here was saying something. Another one over here was saying something. So it was kinda very difficult to even communicate with anybody to be honest with you.

R: I would say it was quite chaotic. There was way too many people in the room. […] [I]t was very loud. I had to step out of the room to call my attending again because I couldn’t hear anything because it was so loud. It was just way too many people in there, too loud. There were also people blocking the doorway, which I think is ridiculous.

Irrespective of the resident level of experience, residents’ narratives were similar when it came to the “chaotic” code environment.

1. Such as a non-cardiac/non-liver-transplant case where the exsanguination protocol is activated and/or 10 or more units of blood products are given. [↑](#footnote-ref-1)