



Launching the feedback revolution: Introduction of a structured framework to begin moving the needle on operative feedback

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**LAUNCHING THE FEEDBACK REVOLUTION: INTRODUCTION OF A
STRUCTURED FRAMEWORK TO BEGIN MOVING THE NEEDLE
ON OPERATIVE FEEDBACK**

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A Thesis Submitted to the Faculty of
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to begin moving the needle on operative feedback**

Abstract

Effective feedback is critically important for growth and development. However, feedback is extremely variable as multiple barriers to delivering and soliciting feedback exist. Furthermore, faculty and residents have differing perceptions of feedback. Surgical faculty, residents, and residency program directors were interviewed to explore diverse perceptions of feedback. Emergent themes included: (1) interest in a structured framework, (2) need for designated time for feedback, and (3) importance of departmental buy-in.

These findings helped design our feedback framework based on a validated operative teaching model. Our framework is centered on components of brainstorm, focus, and recap (BFR) and promotes intentional, direct feedback through a structured and transparent shared mental model between faculty and residents. We aimed to assess the impact of the BFR framework on the quantity and quality of perioperative feedback between surgical faculty and residents.

The BFR framework was introduced to two surgical services for a six-month period. Faculty and residents were invited to utilize the BFR framework for their operative cases. Pre- and post-intervention surveys compared faculty and resident perceptions of feedback. Postoperative surveys monitored weekly use of the framework.

A total of 19 faculty and 56 residents were invited to participate in the study. Faculty and upper-level residents indicated greater frequency and satisfaction with feedback after the

intervention. Although both cohorts reported overall improvement with technical feedback, discrepancies persisted as faculty continued to report giving more frequent, higher-quality feedback than residents reported receiving. Nevertheless, faculty and residents found the structure of the BFR framework to be valuable in engaging with each other.

Feedback plays an indispensable role in surgical training. The BFR framework positively impacted faculty and resident practices and perceptions of feedback, though discrepancies in perceptions remain. Many surrounding pressures of the surgical learning environment can affect the feedback process. Future work should continue optimizing feedback practices and incorporate high-quality feedback with the competency-based assessment system that is approaching implementation in the surgical education community. Targeted initiatives, much like ours, have the potential to transform the culture of feedback in meaningful ways and support the advancement of our residents into confident and competent practice-ready surgeons.

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Chapter 1: Background

1.1 Background and Rationale

Effective feedback is critically important for trainee development and has the potential to play an integral role in their education. However, feedback can be extremely variable, and multiple barriers to delivering high-quality feedback exist such as time, effort, discomfort, competing priorities, and differences in perceptions of feedback.¹⁻⁶ Providing formative feedback on surgical residents' operative performances is an ongoing challenge. The physical and mental demands of surgery residency, coupled with the fast-paced, dynamic climate of the operating room (OR), create a uniquely complex learning environment and present exceptional difficulties with feedback delivery for surgical trainees.^{7,8}

Furthermore, duty hour restrictions and evolving training paradigms have increased the pressure and demands on residents' time, and concerns about surgery residency graduates' inadequate preparation for independent practice have contributed to discussions and decisions surrounding resident entrustment.⁹⁻¹¹ As the American Board of Surgery (ABS) undertakes a monumental movement to institute a competency-based system for assessment and evaluation, it also introduces the possibility of a time-variable model of training, and the importance of efficiency and efficacy of graduate medical education continues to gain traction.¹² Successful implementation of entrustable professional activities (EPAs) will depend heavily on high-quality feedback and assessment of surgical residents in order to support their advancement towards full entrustment as competent independent surgeons.

Despite widespread recognition of the value of feedback, dissatisfaction with feedback remains common among trainees. Different operative performance rating tools and approaches to facilitate feedback delivery have yielded heterogeneous results,¹³⁻¹⁶ and a gold standard method of

feedback delivery has not been identified.^{17,18} Providing high-quality, effective feedback in the surgical learning environment can be complex, perhaps contributing to the absence of a universal comprehensive framework. To further complicate matters, it has also been recognized that a discrepancy exists between faculty and resident views on feedback, and specifically, perioperative teaching and feedback.^{3,19-21} Narrowing this discordance between faculty and resident perceptions can begin ameliorating the challenges and discontent associated with current feedback processes.

Targeted strategies to refine feedback practices have the potential to expedite resident skill development and progression to competence.^{12,22} A better understanding of faculty and resident perceptions of facilitators and barriers to delivering high-quality feedback may elucidate the discrepancy between the two groups. Further, the identification of intervenable factors would subsequently enable the design of targeted strategies to improve feedback delivery and ultimately, cultivate a cultural change such that high-quality feedback becomes a natural expectation and precedent. This organizational transformation can empower faculty and resident collaboration to preserve the educational mission for all. Therefore, we set out to explore improving feedback in the surgical learning environment.

1.2 Pre-Intervention: Qualitative Study

Background

To begin addressing the challenges with feedback, we started with a qualitative study that explored contributing factors to feedback delivery and investigated faculty and resident perceptions in this area. Our aims were: (1) to better understand important facilitators and barriers that influence faculty and resident abilities to provide or ask for effective feedback, and (2) to identify potential intervenable features that would improve the feedback process.

Methods

General surgery faculty and residents from our institution, and general surgery residency program directors from local institutions, were invited to participate via email. Purposive stratified sampling was used to select faculty participants from all surgical specialties and resident participants from all postgraduate years (PGY). This sampling method allowed the selection of participants based on their operative and educational background, knowledge, and experience so that a wide range of perspectives would be acquired. Program directors were invited to participate by convenience sampling.

We developed an interview guide using systematic literature review and expert opinion to identify major themes regarding the feedback process. Open-ended questions were iteratively revised until a final interview guide was established. Questions focused on characteristics of high-quality feedback, contributing factors to feedback, personal feedback practices, and potential approaches to optimize the feedback process.

A combination of semi-structured interviews and focus groups was conducted with study participants by a single member of the research team. Interviews were arranged for faculty and program directors, and focus groups were arranged for residents by PGY class. All interviews were audio-recorded and transcribed verbatim, and all potential identifying information was removed. Two members of the research team independently read and coded transcripts and met regularly to discuss and resolve discrepancies. A preliminary codebook was developed based on initial survey themes and revised during the interviewing time period to include new developing concepts until a finalized codebook was created. Content analysis was used to organize codes into emergent themes. Qualitative analysis was performed using Atlas.ti version 23 (Scientific Software Development).

Results

We conducted semi-structured interviews with 15 faculty, two residents, and three program directors, and focus groups with 13 residents. Focus groups consisted of two to five residents and lasted approximately one hour. Of the 33 total participants, 15 were women (45.5%), which consisted of six faculty (40.0%), eight residents (53.3%), and one program director (33.3%). Preliminary findings revealed emergent themes including: (1) an interest in a structured framework, (2) the need for designated time for formative feedback, and (3) the importance of departmental buy-in regarding efforts to improve feedback.

Next Steps

The emergent themes and additional ideas generated from the perspectives of our faculty and residents have helped inform the design of a new feedback framework that builds on a pre-existing, validated model for methodical teaching in the OR. This new feedback framework is the primary focus of our study intervention.

1.3 Intervention: Brainstorm Focus Recap Framework

The briefing, intraoperative teaching, and debriefing (BID) model developed by Roberts et al. in 2009 is a popular approach for deliberate teaching in the OR that focuses on learner-specific goals before, during, and after a procedure.²³ Based on theories of guided discovery learning and deliberate practice, this model is intended to improve learner performance by targeting the specific needs of the learner, sharing immediate and directed feedback, and reflecting on learned and refined skills. Despite trials of modified versions of the BID model, results have been inconsistent as feedback remains variable, and faculty and resident perceptions of feedback continue to be incongruent.^{24,25} Therefore, we reformed the BID model into a feedback framework characterized

by contextual considerations of our program as a strategy to reinforce its utilization and impact on our educators and learners.

The foundation of our framework is based on the BID model with modifications that incorporate findings from our qualitative study and that are grounded in educational theories. This has resulted in a framework tailored to the needs and interests of our program and integrated with the fundamental components of the BID model. In our framework, the components of the BID model are replaced by 'Brainstorm', 'Focus', and 'Recap' (BFR) to form the BFR framework.

In essence, 'Brainstorm' consists of a preoperative briefing, or pre-briefing, between the faculty and resident to assess the resident's prior experiences with the procedure, review level-specific expectations, and jointly establish learning goals for the case. With 'Focus', faculty and residents can focus on intraoperative, in-the-moment instruction and feedback based on their mutually developed goals. Finally, 'Recap' postoperatively allows the pair to have a dedicated opportunity for a two-way discussion that reviews resident performance, highlights areas of strength and areas needing improvement, and refines new goals for future performances.

Overall, the BFR framework promotes more intentional and focused feedback through a structured shared mental model between faculty and residents. By beginning with an opportunity to collaboratively establish learning goals, the framework encourages an understanding between the faculty and resident on the educational purpose of their time and work together. Incorporation of concepts from a learner-centered approach and self-determination theory invites residents to actively participate in their learning experience, and this has the potential to promote engagement, ownership, retention of newly acquired or refined skills, and subsequently, accelerated mastery of skills.^{26,27} The active involvement of both the faculty and resident in creating learning goals supports a greater sense of purpose surrounding the operative experience and shapes it into a

meaningful teaching and learning opportunity. Similarly, the process of self-reflection on performance skills, needs, and goals can improve self-awareness and foster self-directed learning, all of which may ultimately, amplify learner autonomy. Following Kolb's experiential learning cycle, after a 'concrete experience' is a period of 'reflective observation'—in our context, debriefing after a case—and emphasizes self-reflection in order to analyze and understand the experience so that formed conclusions result in newly learned skills, knowledge, and behaviors.²⁸

Importantly, the construction of our BFR framework was dependent on the perceptions of our faculty and residents, highlighting the necessary partnership between the two in ensuring high-quality feedback. From our qualitative study, we learned that oftentimes the onus of initiating the feedback process is thought to belong to the other party, though we argue that it should be a shared responsibility. Regardless of who initiates it, thoughtful conversations between both cohorts can offer more visibility into the resident's learning needs and experiences, allowing further incorporation of level-specific expectations and goals into the educational experience. This approach can then guide faculty on targeted intraoperative instruction based on their acquired insight into the resident's learning needs. By encouraging more structured, and thus, more transparent, communication, teaching and learning opportunities can be maximized to further enhance surgical training.^{29,30}

Furthermore, to globally evaluate the impact of our BFR framework, we plan to follow the Kirkpatrick evaluation model.³¹ The four levels of this model—reaction, learning, behavior, and results—are intended to analyze how effective our initiative is among our faculty and residents. Through a combination of informal and formal methods of assessment, we plan on demonstrating the value and impact of the BFR framework on our participants' learning and development regarding high-quality, effective feedback.

1.4 Research Question and Aims

Our study proposes the introduction of a BID-based feedback framework with elements co-produced from faculty and resident perceptions in order to assess the impact on the quantity and quality of perioperative feedback. We hypothesize that a purposefully-designed, structured feedback framework will increase the volume of feedback encounters, improve overall feedback quality and satisfaction, and bridge the gap between faculty and resident perceptions. Our specific aims are:

- 1) To introduce a new feedback framework to surgical faculty and residents.
- 2) To assess the impact of a new feedback framework on the volume of feedback encounters.
- 3) To assess the impact of a new feedback framework on the quality of feedback delivered.
- 4) To assess the impact of a new feedback framework on differences between surgical faculty and resident perceptions of feedback.

Chapter 2: Methods

2.1 Study Design

A nonrandomized interventional study was conducted in a general surgery residency program at a single academic institution. The six-month pilot period for utilization of the BFR framework occurred from August 2022 to January 2023. The study took place in the operative environment. The Institutional Review Board determined the study to be exempt from review.

2.2 Study Population

Study participants included faculty and residents from the Brigham and Women's Hospital Department of Surgery. Two general surgery services, trauma and acute care surgery (TACS) and minimally invasive and bariatric surgery (MIS), were selected to partake in the six-month pilot. These services were chosen given the higher volume of faculty on service and a wider variety of operative cases that generally involve all levels of residents in comparison to other surgical services. All faculty from the two services and all residents rotating on the two services during the six-month pilot period were invited to utilize the BFR framework.

2.3 Implementation

The BFR framework was introduced to the two surgical services at the start of the pilot period. During 30-minute introductory sessions, the study and BFR framework were presented virtually to faculty at one of their monthly divisional meetings and in person to residents at one of their weekly didactic sessions. At these sessions, we reviewed the importance of feedback, shared findings from our qualitative study that contributed to our framework development, explained the different components of the BFR framework, and outlined the processes of using the BFR framework and completing postoperative surveys. Posters of the BFR framework were designed,

printed, and displayed in the six ORs and at the respective scrub sinks that the two services most commonly used (**Appendix A**).

During the study, several strategies were employed to promote engagement and utilization of the feedback framework. Reminder emails were sent on a regular basis to the faculty and residents rotating on the two services at the time. At times, these emails included the identification of low and high performers. Two- to four-week-long competitions were held between the two services, and the service that had the highest participation and use of the BFR framework for each competition was awarded a free team lunch. The timing of residents rotating on and off services was also considered when scheduling and organizing competitions. Finally, targeted prompts and reminders to individual faculty and residents further encouraged participants to utilize the BFR framework for their operative cases.

2.4 Data Collection

Data were collected from three surveys. Pre- and post-intervention surveys were developed following a systematic process to optimize our chances of collecting high-quality data (**Appendix B, Appendix C**).³² A thorough literature review explored pre-existing related survey items, and integrating these with findings from our qualitative study enabled our research team to develop clear and relevant survey items. These items were iteratively reviewed and refined through expert validation, cognitive interviews, and pilot testing. The final surveys included items focusing on participant demographics, perceptions of feedback quantity and quality for technical and non-technical feedback, and evaluation of the BFR framework. The pre- and post-intervention surveys were created on a secure web application, REDCap, and distributed electronically by email before and after the pilot period, respectively, to all faculty and resident participants.

Postoperative surveys were also generated on REDCap for faculty and residents and were presented as quick response (QR) codes on the BFR framework posters for participants to access (**Appendix D**). Electronic links to the postoperative surveys were included in the reminder emails to participants. These surveys consisted of two questions that asked participants if feedback was shared, and if so, if the feedback was actionable. Postoperative survey responses were monitored on a weekly basis and compared to the number of weekly cases on each service.

Of note, there have been recent efforts to encourage researchers to use appropriate gender-inclusive language when asking about sex and gender, in which the terminology has quickly evolved with growing numbers of categories of responses as well as recognition of the spectrum of gender identities.^{33,34} While the majority of the current literature, including our study, labels gender as “male” and “female”, inclusive language would support the use of “man” and “woman” to identify gender, and also provide additional response options and an option to decline responding to the question.

2.5 Statistical Analysis

Descriptive statistics were calculated for all survey respondents. Pre- and post-intervention survey responses were then analyzed. Survey items using different Likert scales had five possible responses (i.e. *almost never, several times a month, once a week, several times a week, daily*; or *never, occasionally, sometimes, most of the time, always*; or *not at all, slightly, moderately, very, extremely*; or *strongly disagree, disagree, neither disagree nor agree, agree, strongly agree*). For analysis, Likert scale responses were dichotomized by collapsing responses for the bottom three options and for the top two options. Our findings report the more favorable response options of this two-point scale. Additionally, five Likert scale survey items about the quantity and quality of feedback (frequency of feedback, frequency of actionable feedback, frequency of positive

feedback, comfort with feedback, and satisfaction with feedback) were combined and collapsed to form a comprehensive construct on overall feedback intensity. This was done for both technical and non-technical feedback in order to characterize and capture general perceptions of feedback from faculty and residents.

Student's unpaired *t*-tests were used to compare continuous variables, and chi-square tests were used to compare categorical variables, including the dichotomized Likert scale responses. A difference-in-differences analysis was performed to compare differences in faculty and resident responses before and after the intervention in order to assess the overall impact of the intervention. Additionally, given anecdotal feedback and comments in the post-intervention survey that first-year residents did not spend a substantial amount of time in the OR, a subgroup analysis was performed comparing pre- and post-intervention survey responses after excluding first-year residents. A *p* value <0.05 was considered statistically significant. Statistical analyses were conducted using Stata software version 17 (StataCorp, College Station, TX).

Chapter 3: Results

3.1 Participant Characteristics

Overall, a total of 19 faculty members from the two surgical services and 56 residents in the residency program, for a total of 75 individuals, were invited to participate in the study. The total response rates for the pre- and post-intervention surveys were 48.0% (n=36) and 66.7% (n=50), respectively (**Table 1**). Pre-intervention survey responses consisted of 57.9% of faculty (n=11 of 19) and 44.6% of residents (n=25 of 56), while post-intervention survey responses comprised 78.9% of faculty (n=15 of 19) and 62.5% of residents (n=35 of 56).

Pre-intervention survey respondents only included one female faculty member (9.1%), though this increased to six females (40.0%) with the post-intervention survey for a 100% survey completion rate for female faculty members. Meanwhile, approximately half of resident respondents for both pre- and post-intervention surveys were female. Among both the faculty and residents, those in more senior-level roles (ex. faculty in practice for at least ten years, residents PGY3-5) represented the majority of survey respondents.

Table 1. Participant Characteristics for Pre- and Post-Intervention Surveys

	Faculty			Residents	
	Pre n (%)	Post n (%)		Pre n (%)	Post n (%)
Total respondents	11	15	Total respondents	25	35
Male	10 (90.9)	9 (60.0)	Male	11 (44.0)	18 (51.4)
Female	1 (9.1)	6 (40.0)	Female	14 (56.0)	17 (48.6)
Years in practice			PGY level		
< 5 years	3 (27.3)	4 (26.7)	PGY1	8 (32.0)	13 (37.1)
5-10 years	1 (9.1)	2 (13.3)	PGY2	4 (16.0)	3 (8.6)
> 10 years	7 (63.6)	9 (60.0)	PGY3	7 (28.0)	7 (20.0)
			PGY4	4 (16.0)	5 (14.3)
			PGY5	2 (8.0)	7 (20.0)

3.2 General Perceptions

Prior to the intervention, the majority of faculty (72.7%) and residents (68.0%) felt that there was a need to improve feedback in the residency program. Participants were asked in the pre-intervention survey to describe high-quality, effective feedback (**Table 2**). Faculty and residents agreed that effective feedback is “specific”, “actionable”, “timely” or “in the moment”, and “direct”. Residents also highlighted the “high educational value” of effective feedback from faculty who “[provide] reasoning”, “[focus] on the process of learning”, and explain the differences and path between the resident’s current state and desired state.

Table 2. Descriptions and Representative Quotes of High-Quality Feedback

	Faculty	Residents
Descriptions	<ul style="list-style-type: none">- Specific- Actionable- Timely, in the moment- Direct, focused	<ul style="list-style-type: none">- Specific- Actionable- Timely, in the moment- Direct, straightforward- Positive reinforcement- Well-communicated, kind- Provides reasoning- Goal-oriented, focused on future development- Level-specific expectations
Quotes	<p>“Any feedback that resident recognizes as feedback”</p> <p>“Actionable items to improve on next time with attainable goals”</p> <p>“I think high-quality feedback has a delivery framework of ‘I noticed that..., I think that..., I wonder..., I would recommend...’”</p>	<p>“...Provides real-time, actionable feedback, and reminds you throughout the case so that you can start making it habit. Also provides the reasoning behind every decision [they make] which has extremely high educational value.”</p> <p>“It should be delivered in a way that focuses on the process or learning.”</p> <p>“Describing what you should do differently and why and how to achieve that... Explaining what you’re noticing that I’m not noticing or seeing... helps me learn to see what you’re saying.”</p> <p>“Someone who can [demonstrate] a technical skill for you and watches you practice it, providing feedback. Someone who can point to specific things in your patient management or presentations and let you know where you could’ve done things differently, and which parts are good—encouraging aspects of care helps reinforce them.”</p>

3.3 Pre- and Post-Intervention Perceptions

Faculty and resident responses for the Likert scale survey items were compared for pre- and post-intervention surveys (**Table 3**).

Table 3. Pre- and Post-Intervention Survey Responses

	Pre-Intervention			Post-Intervention			Pre vs Post [†]
	Faculty n (%)	Residents n (%)	P value	Faculty n (%)	Residents n (%)	P value	P value
Total respondents	11	25		15	35		
Technical feedback*							
Frequency, more than once a week	7 (63.6)	15 (60.0)	0.84	12 (80.0)	24 (68.6)	0.41	0.73
Actionable, most of the time or always	9 (81.8)	15 (60.0)	0.20	12 (80.0)	24 (68.6)	0.41	0.64
Positive, most of the time or always	5 (45.5)	5 (20.0)	0.20	12 (80.0)	10 (28.6)	<0.01	0.22
Comfort, very or extremely	8 (72.7)	11 (44.0)	0.11	12 (80.0)	22 (62.9)	0.23	0.61
Satisfaction, very or extremely	3 (27.3)	5 (20.0)	0.63	11 (73.3)	15 (42.9)	0.05	0.30
Non-technical feedback*							
Frequency, more than once a week	4 (36.4)	8 (32.0)	0.80	7 (46.7)	10 (28.6)	0.22	0.55
Actionable, most of the time or always	6 (54.6)	7 (28.0)	0.13	8 (53.3)	11 (31.4)	0.14	0.84
Positive, most of the time or always	5 (45.5)	4 (16.0)	0.06	9 (60.0)	13 (37.1)	0.14	0.77
Comfort, very or extremely	7 (63.6)	7 (28.0)	0.04	11 (73.3)	14 (40.0)	0.03	0.92
Satisfaction, very or extremely	2 (18.2)	4 (16.0)	0.87	9 (60.0)	12 (34.3)	0.09	0.27
Pre-briefing frequency,* more than once a week	1 (9.1)	2 (8.0)	0.91	4 (26.7)	8 (22.9)	0.77	0.88
Debriefing frequency,* more than once a week	5 (45.5)	3 (12.0)	0.03	10 (66.7)	10 (28.6)	0.01	0.82

*Reported responses represent the two more favorable Likert scale response options (i.e. *several times a week, daily; or most of the time, always; or very, extremely; or agree, strongly agree*)

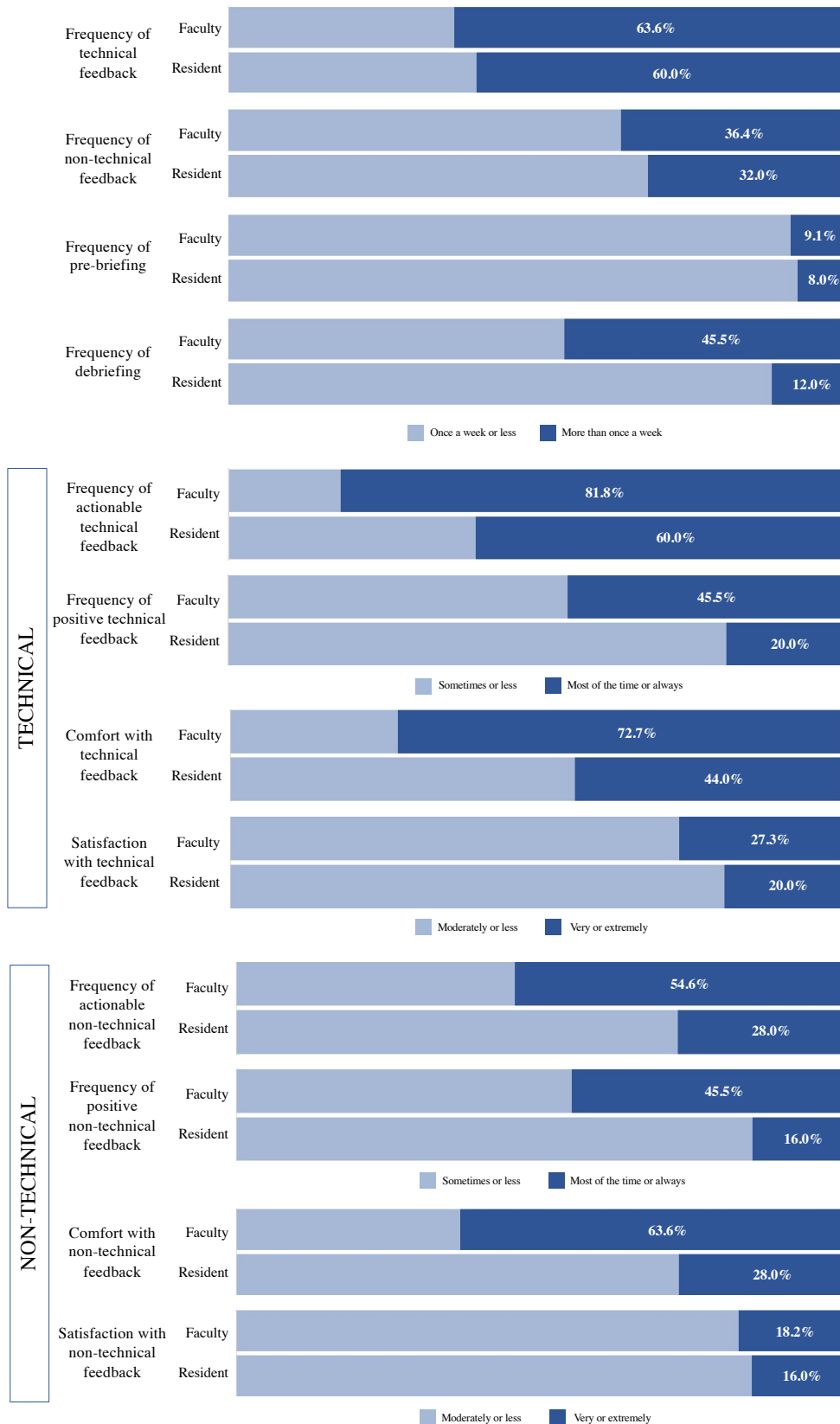
[†]Difference-in-differences analysis, comparing the differences in pre-intervention faculty versus resident responses with the differences in post-intervention faculty versus resident responses

Pre-Intervention Survey

Faculty were more likely to report greater comfort with giving non-technical feedback than residents felt with asking for it (63.6% vs 28.0%, $p=0.04$). Faculty also indicated a higher frequency of debriefing than residents (45.5% vs 12.0%, $p=0.03$). Otherwise, the majority of pre-intervention outcomes showed no significant differences between faculty and resident responses regarding the frequency and quality of feedback being shared. Nevertheless, for each Likert scale survey item, faculty had higher rates of favorable responses than residents (**Figure 1**).

Additional findings to note, despite their non-significance, include differences in the frequency of technical versus non-technical feedback delivery. While the majority of both groups reported giving or receiving technical feedback more than once a week (63.6% faculty vs 60.0% residents), this rate dropped by nearly half for non-technical feedback with both cohorts (36.4% faculty vs 32.0% residents). Importantly, satisfaction with feedback was quite low for both technical (27.3% faculty vs 20.0% residents) and non-technical (18.2% faculty vs 16.0% residents) feedback. Similarly, very few respondents stated that they pre-briefed more than once a week (9.1% faculty vs 8.0% residents).

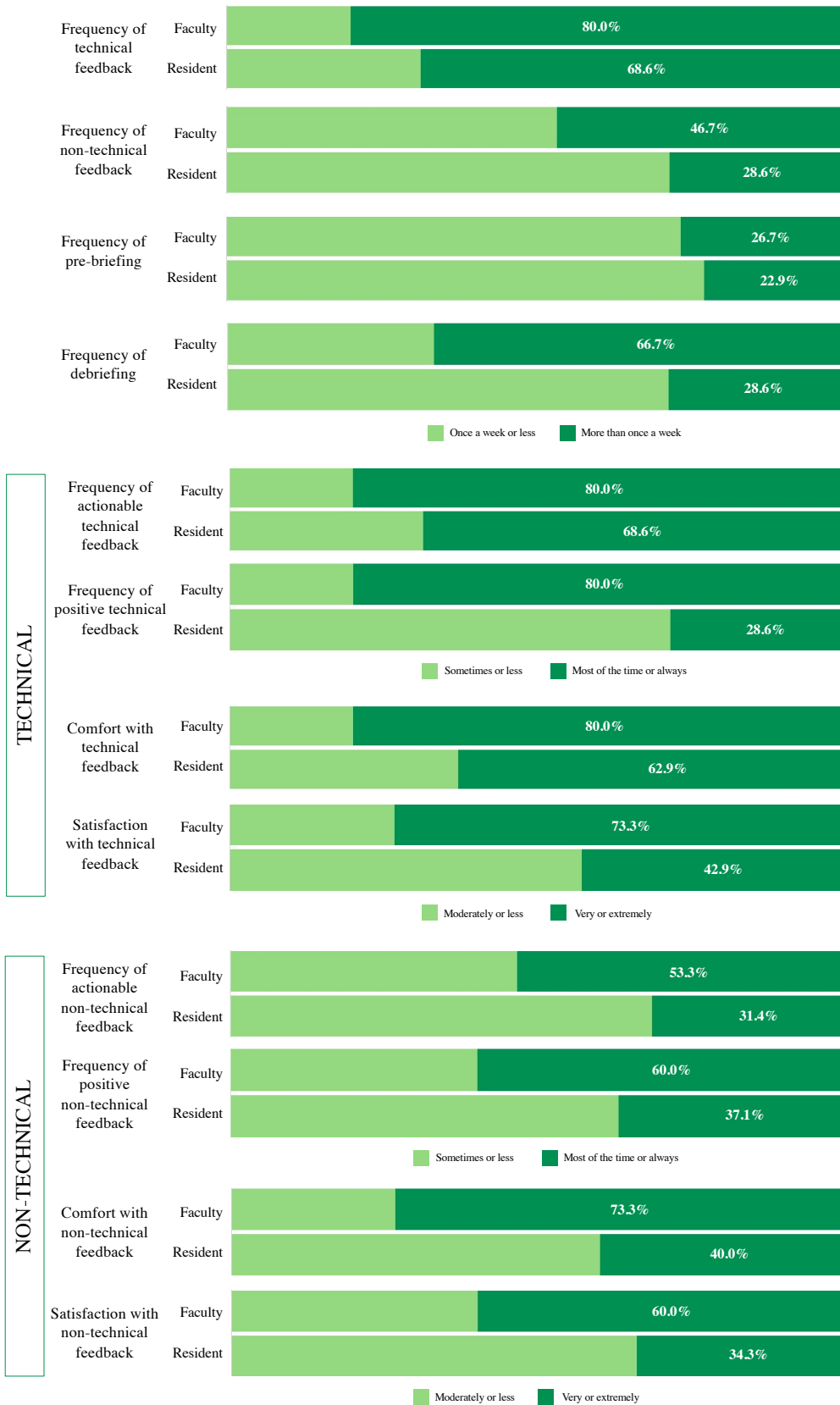
Figure 1. Pre-Intervention Survey Responses, by Role



Post-Intervention Survey

After the intervention, a statistically significant difference was again identified between faculty and resident perceptions of comfort with non-technical feedback (73.3% vs 40.0%, $p=0.03$). Similarly, the frequency of debriefing continued to be higher with faculty than residents (66.7% vs 28.6%, $p=0.01$). There was a newly significant difference between faculty and resident satisfaction with technical feedback (73.3% vs 42.9%, $p=0.05$). Interestingly, there was a significantly higher frequency of positive technical feedback reported by faculty than residents (80.0% vs 28.6%, $p<0.01$), and when compared to pre-intervention responses (45.5% vs 20.0%), we notice a considerable increase among faculty without a corresponding increase among residents after the intervention. Overall, faculty continued to report higher rates of favorable responses in comparison to residents in the Likert scale survey items (**Figure 2**).

Figure 2. Post-Intervention Survey Responses, by Role



Pre- versus Post-Intervention Surveys

As shown in **Table 3**, the difference-in-differences analysis that compared the differences between faculty and resident responses from pre-intervention to post-intervention revealed no statistically significant differences.

Outcomes were also compared within each cohort to assess for pre- and post-intervention differences among faculty and among residents (**Table 4**). In comparing faculty responses before and after the intervention, there were significant increases in satisfaction with technical (27.3% to 73.3%, $p=0.01$) and non-technical (18.2% to 60.0%, $p=0.02$) feedback. No significant differences were found between pre- and post-intervention responses among the residents.

Table 4. Pre- and Post-Intervention Survey Responses, by Role

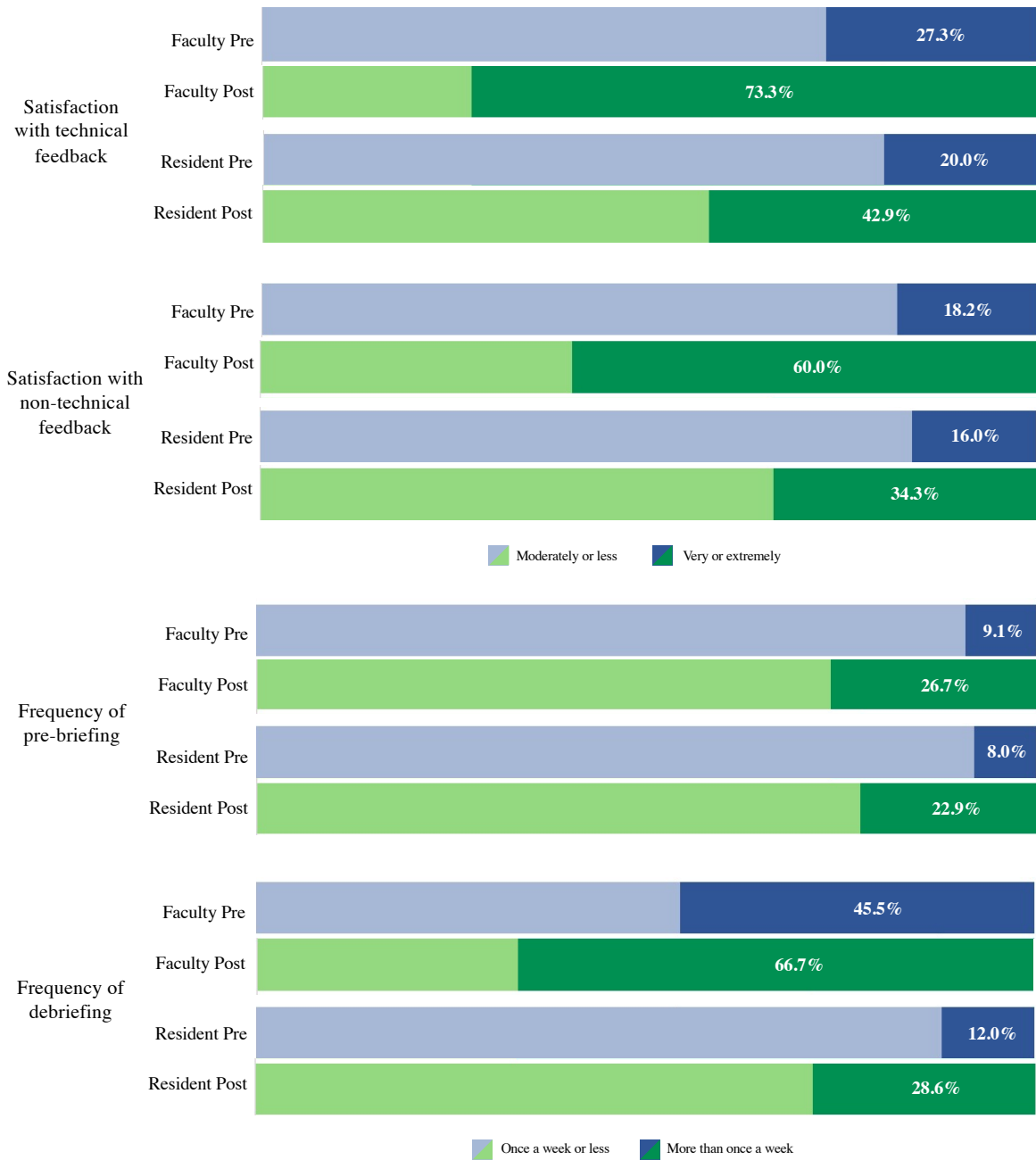
	Faculty			Residents		
	Pre n (%)	Post n (%)	P value	Pre n (%)	Post n (%)	P value
Total respondents	11	15		25	35	
Technical feedback*						
Frequency, more than once a week	7 (63.6)	12 (80.0)	0.39	15 (60.0)	24 (68.6)	0.49
Actionable, most of the time or always	9 (81.8)	12 (80.0)	0.92	15 (60.0)	24 (68.6)	0.48
Positive, most of the time or always	5 (45.5)	12 (80.0)	0.05	5 (20.0)	10 (28.6)	0.47
Comfort, very or extremely	8 (72.7)	12 (80.0)	0.70	11 (44.0)	22 (62.9)	0.14
Satisfaction, very or extremely	3 (27.3)	11 (73.3)	0.01	5 (20.0)	15 (42.9)	0.06
Non-technical feedback*						
Frequency, more than once a week	4 (36.4)	7 (46.7)	0.59	8 (32.0)	10 (28.6)	0.79
Actionable, most of the time or always	6 (54.6)	8 (53.3)	0.95	7 (28.0)	11 (31.4)	0.79
Positive, most of the time or always	5 (45.5)	9 (60.0)	0.44	4 (16.0)	13 (37.1)	0.09
Comfort, very or extremely	7 (63.6)	11 (73.3)	0.61	7 (28.0)	14 (40.0)	0.34
Satisfaction, very or extremely	2 (18.2)	9 (60.0)	0.02	4 (16.0)	12 (34.3)	0.12
Pre-briefing frequency,* more than once a week	1 (9.1)	4 (26.7)	0.25	2 (8.0)	8 (22.9)	0.14
Debriefing frequency,* more than once a week	5 (45.5)	10 (66.7)	0.23	3 (12.0)	10 (28.6)	0.15

*Reported responses represent the two more favorable Likert scale response options (i.e. *several times a week, daily; or most of the time, always; or very, extremely; or agree, strongly agree*)

Several survey items were deemed by the authors to hold more meaningfulness in the context of this study and the BFR framework (**Figure 3**). Given prior recognition of trainee dissatisfaction with feedback, faculty and resident satisfaction with technical and non-technical feedback were compared. While both faculty and residents reported low rates of feeling ‘very’ or ‘extremely’ satisfied with technical and non-technical feedback prior to the intervention, there were increased rates of post-intervention satisfaction in both types of feedback and in both cohorts. Universally, there were more than double the rates of satisfaction after the intervention, though only faculty reports of greater satisfaction with technical and non-technical feedback were statistically significant.

The frequencies of pre-briefing and debriefing were also identified as important elements of feedback to examine closely. Although there were no differences between faculty and resident reports of pre-briefing neither before nor after the intervention, and despite upward trends in both cohorts after the intervention, the low rates indicated by everyone pre- and post-intervention are critical. In contrast, faculty reported significantly higher frequencies of debriefing than residents before and after the intervention. Both cohorts also demonstrated increased rates of debriefing post-intervention compared to pre-intervention, though these results were non-significant.

Figure 3. Select Pre- and Post-Intervention Survey Responses



Subgroup Analysis Excluding PGY1 Residents

After excluding first-year resident responses, statistical analyses were repeated. As opposed to the lack of noteworthy findings between pre- and post-intervention responses for all residents, several significant results were detected with this subgroup (**Table 5**). Upper-level residents reported a greater frequency of technical feedback after the intervention compared to before (86.4% vs 58.8%, p=0.05). Additionally, there was improved satisfaction with the technical feedback received post-intervention (54.6% vs 17.7%, p=0.02). Finally, this group of residents indicated significantly higher frequencies of pre-briefing after the intervention than before (31.8% vs 5.9%, p=0.05).

Table 5. Pre- and Post-Intervention Survey Responses of Residents Excluding PGY1s

	Pre-Intervention n (%)	Post-Intervention n (%)	P value
Total respondents	17	22	
Technical feedback*			
Frequency, more than once a week	10 (58.8)	19 (86.4)	0.05
Actionable, most of the time or always	11 (64.7)	17 (77.3)	0.39
Positive, most of the time or always	3 (17.7)	8 (36.4)	0.20
Comfort, very or extremely	7 (41.2)	15 (68.2)	0.09
Satisfaction, very or extremely	3 (17.7)	12 (54.6)	0.02
Non-technical feedback*			
Frequency, more than once a week	6 (35.3)	10 (45.5)	0.52
Actionable, most of the time or always	5 (29.4)	5 (22.7)	0.64
Positive, most of the time or always	4 (23.5)	10 (45.5)	0.16
Comfort, very or extremely	5 (29.4)	10 (45.5)	0.31
Satisfaction, very or extremely	4 (23.5)	10 (45.5)	0.16
Pre-briefing frequency,* more than once a week	1 (5.9)	7 (31.8)	0.05
Debriefing frequency,* more than once a week	3 (17.7)	9 (40.9)	0.12

*Reported responses represent the two more favorable Likert scale response options (i.e. *several times a week, daily*; or *most of the time, always*; or *very, extremely*; or *agree, strongly agree*)

The pre- and post-intervention survey responses for this subgroup of residents were also compared to faculty responses (**Table 6**). The post-intervention frequency of positive technical feedback is the only significant finding identified, with faculty reporting higher rates than upper-level residents (80.0% vs 36.4%, $p=0.01$). As previously noted, this significant difference was also present in comparing post-intervention outcomes between faculty and all residents. There were no statistically significant differences between faculty and upper-level residents across all pre-intervention outcomes, nor when comparing the differences between faculty and resident responses from pre-intervention to post-intervention after first-year residents were removed from the resident cohort.

Table 6. Pre- and Post-Intervention Survey Responses of Faculty Compared to Residents Excluding PGY1s

	Pre-Intervention		Post-Intervention		Pre vs Post [§]
	Faculty n (%)	P value [†]	Faculty n (%)	P value [‡]	P value
Total respondents	11		15		
Technical feedback*					
Frequency, more than once a week	7 (63.6)	0.80	12 (80.0)	0.61	0.62
Actionable, most of the time or always	9 (81.8)	0.33	12 (80.0)	0.84	0.52
Positive, most of the time or always	5 (45.5)	0.11	12 (80.0)	0.01	0.50
Comfort, very or extremely	8 (72.7)	0.10	12 (80.0)	0.43	0.42
Satisfaction, very or extremely	3 (27.3)	0.54	11 (73.3)	0.25	0.70
Non-technical feedback*					
Frequency, more than once a week	4 (36.4)	0.95	7 (46.7)	0.94	0.99
Actionable, most of the time or always	6 (54.6)	0.18	8 (53.3)	0.06	0.82
Positive, most of the time or always	5 (45.5)	0.23	9 (60.0)	0.39	0.77
Comfort, very or extremely	7 (63.6)	0.07	11 (73.3)	0.09	0.80
Satisfaction, very or extremely	2 (18.2)	0.74	9 (60.0)	0.39	0.42
Pre-briefing frequency,* more than once a week	1 (9.1)	0.75	4 (26.7)	0.74	0.68
Debriefing frequency,* more than once a week	5 (45.5)	0.11	10 (66.7)	0.12	0.93

*Reported responses represent the two more favorable Likert scale response options (i.e. *several times a week, daily; or most of the time, always; or very, extremely; or agree, strongly agree*)

[†]P value compares pre-intervention faculty versus resident responses (Table 5)

[‡]P value compares post-intervention faculty versus resident responses (Table 5)

[§]Difference-in-differences analysis, comparing the differences in pre-intervention faculty versus resident responses with the differences in post-intervention faculty versus resident responses

Feedback Intensity

The overall intensities of both technical and non-technical feedback were measured by combining the five Likert scale survey items focused on the quantity and quality of feedback (**Table 7**). In the pre-intervention survey, faculty reported a significantly higher feedback intensity than residents for both technical (58.2% vs 41.6%, $p=0.04$) and non-technical (43.6% vs 24.0%, $p=0.01$) feedback. These significant differences remained true in the post-intervention survey as well. The difference-in-differences analysis yielded no differences between faculty and resident responses from pre-intervention to post-intervention. When comparing technical feedback intensity within each cohort, there were significant improvements from before to after the intervention for both faculty (58.2% to 78.7%, $p=0.01$) and residents (41.6% to 54.3%, $p=0.03$). No differences were identified for non-technical feedback intensity with either cohort.

Table 7. Changes in Technical and Non-Technical Feedback Intensity

	Pre-Intervention			Post-Intervention			Pre vs Post [†]
	Faculty n (%)	Residents n (%)	P value	Faculty n (%)	Residents n (%)	P value	P value
Technical	32 (58.2)	52 (41.6)	0.04	59 (78.7)	95 (54.3)	<0.01	0.45
Non-technical	24 (43.6)	30 (24.0)	0.01	44 (58.7)	60 (34.3)	<0.01	0.64

	Faculty			Residents		
	Pre n (%)	Post n (%)	P value	Pre n (%)	Post n (%)	P value
Technical	32 (58.2)	59 (78.7)	0.01	52 (41.6)	95 (54.3)	0.03
Non-technical	24 (43.6)	44 (58.7)	0.09	30 (24.0)	60 (34.3)	0.06

[†]Difference-in-difference analysis, comparing the differences in pre-intervention faculty versus resident responses with the differences in post-intervention faculty versus resident responses

3.4 BFR Framework Perceptions

In the post-intervention survey, faculty and residents were asked to rate how frequently they used the BFR framework and their level of agreement with various statements about the BFR framework (**Table 8**). Given reports of never using the BFR framework, one faculty member and eight residents were excluded from the analysis. Five residents who completed the post-intervention survey did not rotate on the TACS or MIS services during the six-month pilot period and were also excluded. Fourteen faculty and 22 resident responses were included in this analysis. Overall, there were no significant differences between faculty and resident ratings of the BFR framework. Notably, despite low reports of using the BFR framework ‘most of the time’ or ‘always’ from faculty (35.7%) and residents (13.6%), the majority of respondents from both cohorts reported favorably in all statements about the framework.

Table 8. Post-Intervention Survey Responses Regarding the BFR Framework*

	Faculty n (%)	Residents n (%)	P value
Total respondents	14	22	
Frequency of use, most of the time or always	5 (35.7)	3 (13.6)	0.12
Identifies areas of strength	9 (64.3)	13 (59.1)	0.76
Identifies areas needing improvement	11 (78.6)	15 (68.2)	0.50
Promotes more focused feedback	12 (85.7)	16 (72.7)	0.36
Promotes more discussion on learning goals	11 (78.6)	15 (68.2)	0.50
Effective approach to feedback delivery	12 (85.7)	15 (68.2)	0.24
Will continue to utilize the framework	11 (78.6)	14 (63.6)	0.34
Right amount of time	12 (85.7)	16 (72.7)	0.36

*Reported responses represent the two more favorable Likert scale response options (i.e. *agree*, *strongly agree*; or *most of the time*, *always*).

Faculty and residents also had the opportunity to share additional comments, such as facilitators and barriers, about the BFR framework in the post-intervention survey (**Table 9**). Both cohorts agreed that the framework was “organized”, “intuitive”, and “easy to use”. Similarly, everyone liked that the BFR framework helped “[prime]” or “engage” their counterpart with the feedback process. However, both faculty and residents stated that “time” was a barrier to its use. While faculty reported that merely “remembering to use” the framework was a challenge, residents noted various difficulties with faculty related to their awareness, willingness, and availability when using the feedback framework.

Table 9. Facilitators and Barriers to Using the BFR Framework

	Faculty	Residents
Facilitators	<ul style="list-style-type: none"> - Formalizes process - Structured, organized - Focused goals - Quick intuitive framework - Helped prime residents - Visual cue and reminder to provide feedback - Ease and accessibility of QR code 	<ul style="list-style-type: none"> - Established framework - Organized - Easy to use - Helped engage faculty
Barriers	<ul style="list-style-type: none"> - Time - Remembering to use - Remembering to complete the postoperative survey 	<ul style="list-style-type: none"> - Time - Faculty unaware of the framework - Faculty willingness to give feedback - Faculty availability at the start of the case - Utility for first-year residents who aren't frequently in the OR - QR codes absent at other ORs

3.5 Postoperative Survey Responses

Postoperative survey responses, which served as a marker for the use of the BFR framework and feedback delivery, were collected weekly and compared to the number of weekly cases for the TACS (**Figure 4**) and MIS (**Figure 5**) services. Trendlines demonstrated positive trends over time with survey responses for both services' faculty and residents. Shaded and non-shaded regions in the graphs distinguished competition and non-competition, or regular, weeks.

Figure 4. TACS Service Average Weekly Postoperative Survey Responses

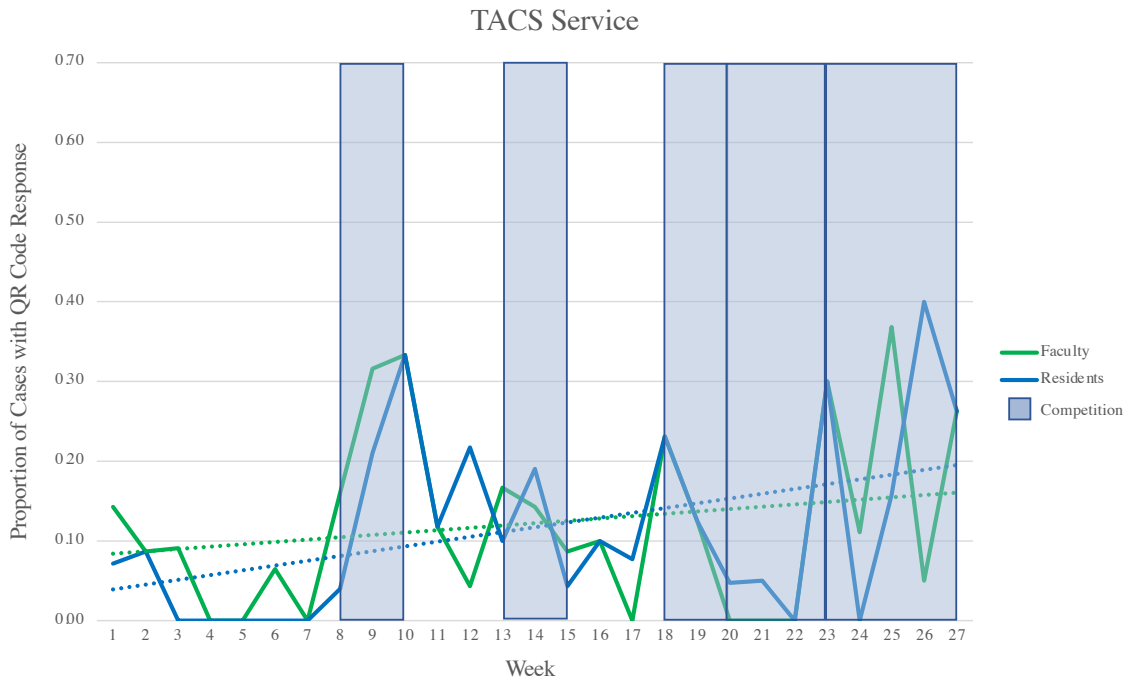
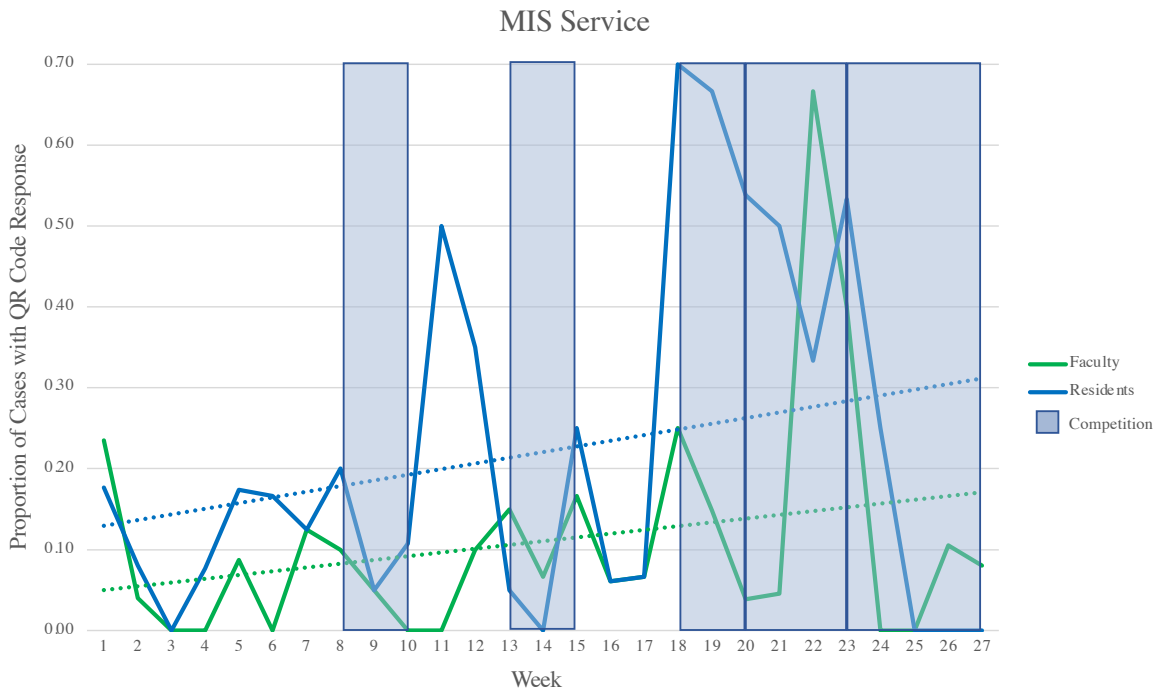


Figure 5. MIS Service Average Weekly Postoperative Survey Responses



Average weekly postoperative survey responses were compared between the TACS and MIS services' faculty and residents (**Table 10**). During the six-month pilot period, a total of 27 and 17 residents rotated on the TACS and MIS services, respectively, and there were generally five TACS residents and three MIS residents on the services at a time. The two services had nearly equal numbers of average weekly cases, with 21.07 and 21.22 cases on the TACS and MIS services, respectively.

While there were no differences in average survey responses per week between TACS faculty and TACS residents, MIS residents had a significantly higher average response rate than their respective faculty (4.48 ± 4.87 responses vs 1.93 ± 1.71 responses, $p=0.01$). When a service's faculty and residents were combined, there were no differences between the entire TACS service and the entire MIS service. However, when the two services' faculty were combined and compared to the two services' residents, residents had a higher average response rate than faculty (6.67 ± 5.26 responses vs 4.26 ± 2.85 responses, $p=0.04$).

Table 10. Average Weekly Postoperative Survey Responses

	TACS Service			MIS Service		
	Faculty	Residents*	P value	Faculty	Residents*	P value
Total participants	11	27		8	17	
Cases/week		21.07			21.22	
Responses/week	2.33 ± 2.06	2.19 ± 2.11	0.80	1.93 ± 1.71	4.48 ± 4.87	0.01
During competition weeks	3.21 ± 2.39	3.00 ± 2.32	0.81	2.36 ± 1.82	5.57 ± 6.28	0.08
During regular weeks	1.38 ± 1.04	1.31 ± 1.49	0.88	1.46 ± 1.51	3.31 ± 2.39	0.03
	Combined					
	All TACS Service			All MIS Service		P value
Responses/week	4.52 ± 3.60			6.41 ± 5.70		0.15
During competition weeks	6.21 ± 3.93			7.93 ± 7.12		0.44
During regular weeks	2.69 ± 2.10			4.77 ± 3.14		0.06
	All Faculty			All Residents		P value
Responses/week	4.26 ± 2.85			6.67 ± 5.26		0.04
During competition weeks	5.57 ± 3.11			8.57 ± 6.05		0.11
During regular weeks	2.85 ± 1.72			4.62 ± 3.40		0.11

*Total number of residents who rotated on the service during the six-month pilot period; there were generally five TACS residents and three MIS residents on the services at a time

Average weekly response rates were also compared between competition weeks and regular weeks (**Table 11**). This revealed a significantly higher response rate when a competition was held for the entire TACS service (6.21 ± 3.93 responses vs 2.69 ± 2.10 responses, $p < 0.01$), including separately among TACS faculty (3.21 ± 2.39 responses vs 1.38 ± 1.04 responses, $p = 0.02$) and TACS residents (3.00 ± 2.32 responses vs 1.31 ± 1.49 responses, $p = 0.03$). Similarly, when the two services' faculty and residents were combined and grouped by role, average weekly response rates for all faculty (5.57 ± 3.11 responses vs 2.85 ± 1.72 responses, $p = 0.01$) and all residents (8.57 ± 6.05 responses vs 4.62 ± 3.40 responses, $p = 0.05$) were higher during competition weeks than regular weeks. No significant differences were identified with the MIS service.

Table 11. Average Weekly Postoperative Survey Responses for Competition and Regular Weeks

	Competition Weeks	Regular Weeks	P value
All TACS service	6.21 ± 3.93	2.69 ± 2.10	< 0.01
TACS faculty	3.21 ± 2.39	1.38 ± 1.04	0.02
TACS residents	3.00 ± 2.32	1.31 ± 1.49	0.03
All MIS service	7.93 ± 7.12	4.77 ± 3.14	0.15
MIS faculty	2.36 ± 1.82	1.46 ± 1.51	0.18
MIS residents	5.57 ± 6.28	3.31 ± 2.39	0.23
All faculty combined	5.57 ± 3.11	2.85 ± 1.72	0.01
All residents combined	8.57 ± 6.05	4.62 ± 3.40	0.05

Chapter 4: Discussion

4.1 Overview, Interpretations, and Perspectives

Our study introduced a new feedback framework, deliberately tailored to meet the interests and needs of our faculty and residents and assessed its impact on the quantity and quality of perioperative feedback. After conducting an initial needs assessment through qualitative interviews and focus groups, we developed and implemented our BFR framework as a dedicated first step to addressing challenges of the feedback process and improving perioperative feedback in our program.

Overall, we found that faculty and residents reported improvements in technical feedback after a six-month period piloting the BFR framework. Specifically, there were higher frequencies of feedback delivery and pre-briefing and greater satisfaction among faculty and upper-level residents. Although there was no significant difference in the frequency of debriefing, the increasing trends among both cohorts after the intervention may indicate that these postoperative conversations were occurring more regularly. Ultimately, despite low rates of regular use of the framework, our faculty and residents still found value in the BFR framework.

We reformed the BID model to create a feedback framework specific to our program. Notably, our faculty and resident post-intervention perspectives on the BFR framework aligned smoothly with the themes identified in our qualitative study that helped construct the framework (i.e. structured framework, designated time, departmental buy-in), thus suggesting the effectiveness of our tailored framework in meeting the needs of our program. Faculty and residents reported that the structured and organized framework was easy to use. Having a formalized process and dedicated opportunity to focus on learner goals was also impactful, though time remained a significant barrier. Finally, the framework helped faculty and residents engage with each other—

this may be one of the most meaningful consequences of our project, as greater investment from both parties in the feedback process is integral in promoting best practices and transforming mindsets in the surgical learning environment. Therefore, our program-specific framework has started to shift the culture of feedback in small, though meaningful, ways.

Nevertheless, differing perceptions of feedback between faculty and residents still exist. Faculty continue to report giving more frequent, higher-quality feedback than residents report receiving, as this pattern remained consistent from before to after our intervention. This disparity between faculty and resident perceptions of feedback is not an unfamiliar dilemma to medical educators.^{19,20} Understanding that a consensual definition of feedback was lacking and rather, that everyone's varying conceptual representations of feedback likely hinder straightforward recognition of feedback,²¹ we intentionally devised our feedback framework to promote clear communication and transparency during the opportunities designated for feedback before and after an operation. Effective feedback is a two-way conversation, not a one-way process, and the structure of our framework facilitates the shared discussion and recognition of feedback being given and received. Ultimately, this enhanced clarity can considerably improve overall satisfaction with feedback, which was noted by our faculty and upper-level residents after the introduction of our framework.

For this reason, the pre-briefing and debriefing components of our framework are of paramount importance, as they are centered on the faculty-resident pair building a shared mental model together. Given the fast-paced, high-stress nature of the operative environment, these dedicated opportunities to discuss learning objectives before and after an operative case have the potential to maximize the educational experience. With a greater frequency of pre-briefing reported after the intervention, our BFR framework encouraged faculty and residents to outline

goals and expectations prior to their cases. Debriefing was performed more frequently than pre-briefing and more frequently by faculty than residents. The former observation may be due to the widely recognized approach to feedback that occurs after a ‘concrete experience’—as it is known in Kolb’s learning cycle—and traditionally does not include a preparatory feature such as pre-briefing.²⁸ We surmise that the differences in frequencies of debriefing between faculty and residents are largely explained by the aforementioned lack of clarity with the definition of feedback. Nevertheless, our BFR framework promoted the value of pre-briefing and debriefing, and these opportune spaces and times can optimize teaching and learning.

These designated opportunities to have meaningful conversations focused on promoting performance improvement are most productive when the faculty and resident have a shared understanding of learning objectives, expectations, and the type of feedback needed or desired. Misalignments in their perspectives can lead to disappointment and dissatisfaction. The SMART (specific, measurable, achievable, relevant, time-bound) framework is a longstanding, commonly used guide for goal setting,³⁵ and our faculty and residents report several identical features that are important in high-quality feedback. Notably, residents identified additional properties they believed to characterize high-quality feedback such as being well-communicated, justified, applicable to level-specific goals and expectations, and comprehensive in describing both the observed behavior as well as how to change to reach the desired state. These novel features of feedback are quite distinctive from both the SMART framework and our faculty descriptions of high-quality feedback, thus, corroborating the discordance between faculty and resident perspectives.

Our study demonstrated a range of results for different aspects of feedback after our intervention—greater frequency and satisfaction among faculty and upper-level residents,

persistent discrepancies with other features, and ultimately, a significant improvement in overall technical feedback intensity for faculty and all residents. This assortment suggests that feedback, especially high-quality feedback, is remarkably complex; hence, why it remains a perpetual challenge in medical education. Even though the construction of our BFR framework was guided by the contextual elements of our program to optimize its usage and impact, the framework alone was likely insufficient in overcoming the surrounding pressures of the surgical learning environment. Many unique aspects of surgical residency training and the operative environment have the potential to disrupt our implementation and dissemination of the framework, our participants' utilization of the framework, and their recognition of its impact.

The high volume of work during a typical workday for surgeons is well-known and cannot be underestimated. As a result, educational opportunities are often informal, unstructured, and of variable quality. Time constraints and work demands are substantial challenges to the feedback process in the clinical environment, as today's providers are juggling more clinical, research, and administrative responsibilities than ever before.³⁶ Furthermore, the service-to-education imbalance in graduate medical education is exacerbated by duty hour restrictions without a corresponding reduction in workload, leading to worsening work compression and subsequent resident burnout, unfavorable educational experiences, and adverse patient outcomes.³⁷⁻⁴⁰ Unfortunately, in the current climate of increasing work demands, education is often superseded by patient care and other clinical duties, and feedback is undoubtedly overshadowed as well. Designated time for feedback was a critical theme in our qualitative study, and despite efforts with the BFR framework to promote opportunities for discussion, time was still cited by faculty and residents as a barrier to using the framework. Thus, regardless of the universal support and acceptance of the value of feedback, extreme workloads and conflicting priorities often outweigh educational processes.

The burden of balancing competing priorities is accompanied by the complex learning environment of the OR and the unique nature of different surgical specialties as additional stressors to effective feedback delivery. The physical and mental demands of surgical training, the fast-paced and dynamic climate of the OR, and the infrastructure of surgical services requiring residents to frequently rotate among different faculty members all contribute to difficulties with perioperative teaching and feedback.^{7,8} Similarly in our study, the distinctive properties of the TACS and MIS services need to be considered when interpreting our findings. While the unpredictability of the TACS service arises from unexpected traumas, emergencies, and acutely and critically ill patients, the MIS service is situated on the other end of the spectrum, characterized by a predominantly elective practice that generally manages healthier patients, shorter hospitalizations, and fewer complications. As a result, the variability and uncertainty of the TACS workflow likely lead to more informal, impromptu feedback encounters and the reported fewer weekly postoperative survey responses in comparison to the MIS service.

While these environmental factors can impact one's capacity to utilize the BFR framework on a regular basis, there are substantial intrinsic factors to consider as well. Knowing that deep-seated obstacles with delivering and soliciting feedback would be challenging to overcome, we incorporated a gamification approach to encourage engagement and utilization of the framework. Surgical personalities are traditionally known to be competitive, task-focused, and results-oriented, and thus, gamification strategies targeted at organized, team-based competition can be strong motivating factors for surgeons.^{41,42} Our findings demonstrated that faculty and residents, and particularly the TACS service, were responsive to our gamification tactics. The faster pace and acute demands of the TACS environment may predispose its members to be more enticed by competition than those accustomed to a more orderly setting. Nonetheless, weekly postoperative

survey response rates were relatively low and inconsistent, and it is evident that gamification, while effective to some extent, was likely inadequate in ensuring sustained engagement.

Finally, interpersonal dynamics is another notable factor that could have influenced the use and effects of our framework. A fundamental principle of the BFR framework is the value of the two-way conversation between the educator and learner. However, if the relationship between the faculty and resident is problematic, suboptimal, or simply underdeveloped, both individuals may feel less comfortable with delivering, receiving, or asking for feedback. An established rapport brings about mutual respect, trust, and commitment to the partnership that can promote heightened investment in educational and operative experiences with one another.⁴³ In our study, several aspects of feedback became significantly improved among the residents after first-year residents were excluded, suggesting that the time that upper-level residents invest in their training and spend longitudinally with faculty is a considerable facilitator to high-quality, effective feedback.

Many extrinsic and intrinsic factors in the surgical learning environment must be appreciated when implementing an educational initiative and assessing its impact. The dynamic complexity of feedback requires purposeful and persistent efforts to tackle these challenges and bring about a culture change. Our study formulated and introduced a feedback framework aligned with the interests and needs of the members of our program and ultimately, demonstrated improvements in several areas of feedback among our faculty and residents. While our findings are encouraging, much more work is needed to continue pursuing best practices of high-quality feedback in the clinical environment and advancing the educational mission of our surgical community.

4.2 Project Impact

The overall intent of our study was to improve the quantity and quality of feedback encounters between surgical faculty and residents through the introduction of a purposefully-designed feedback framework. An essential objective of the BFR framework was to equip faculty and residents with an organized approach for productive and meaningful discussions in the feedback process. This work has the potential to bridge the gap between faculty and resident perceptions of feedback and shift the surgical culture such that high-quality feedback is consistently delivered, received, and expected. Moreover, we hope involving both faculty and residents and exploring their perspectives to construct our co-produced framework will inspire further collaborative efforts with refining feedback practices that meaningfully transform our program's educational experiences.

A shared mental model between the faculty and resident empowers guided learning and performance improvement by promoting opportunities to set and communicate learning objectives and expectations together. Goal-oriented feedback has the immense potential to generate rich learning opportunities, as faculty feedback on resident performance can be structured around the common language derived from their established understanding and goals for educational advancement. As a result, high-quality feedback can accelerate skills development, enhance self-awareness and self-assessment, and inspire greater confidence.⁴⁴

Kirkpatrick's evaluation model was used to evaluate the effectiveness and impact of our initiative.³¹ Following the four-level model, we assessed our participants' reactions to the BFR framework after the introductory sessions and throughout the project pilot period. We were able to measure improvements in participants' learning and behavior through our data analysis by comparing their pre- and post-intervention perceptions of feedback. Finally, the fourth level in

Kirkpatrick's model that determines how our framework influenced organizational performance can be loosely guided by our post-intervention survey responses as well, though further evaluation involving qualitative methods and additional metrics of resident competence and patient outcomes would be worthwhile.

4.3 Implications

The transition to competency-based medical education is a transformative movement in the history of graduate medical education. The ABS is set to launch EPAs in general surgery residency programs nationwide in July of 2023, and substantial progress will be made in feedback-oriented assessments of resident performance. High-quality feedback will emerge as practical EPA microassessments and successful advancements of residents into practice-ready surgeons. Our study presented an opportunity to identify best practices and challenges of feedback that can be broadly incorporated with the implementation of EPAs.

A core component of the EPA microassessment is rating the resident level of entrustment, which ranges from 'limited participation' to 'practice ready'.^{11,12} Faculty and residents will be able to access a resident's compilation of EPA data, which can serve as a valuable point of conversation when pre-briefing, as the pair reviews the resident's prior experiences and entrustment ratings. This heightened visibility of a resident's competence has the potential to accelerate operative autonomy and progression to practice-ready independence. Furthermore, narrative feedback will be another significant component of these assessments, and when done properly, can effectively drive learning and performance improvement. Today's residents have different needs and expectations with high-quality feedback that vary between different levels of training and that are much more elaborate than the time-honored SMART framework. Thus, particular mindfulness of

the narrative feedback provided can foster greater resident satisfaction, receptivity, and comprehension of their feedback and their level of entrustment.

A competency-based framework relies on more frequent, low-stakes workplace-based assessments that are used to support summative evaluations. Despite the potential benefits of an increased volume of formative feedback, recent studies have demonstrated concerns with assessment burdens and the subsequent loss of meaningful feedback.^{45,46} To avoid devaluing the feedback process to a sense of “checking boxes” to fulfill an administrative task, a reconciliation of the tension between increasing the frequency of assessments and preserving high-quality feedback is needed. Mitigating the onerous perceptions regarding EPA assessments can be pursued by demonstrating the values of EPAs for all stakeholders and highlighting the importance of shared responsibility from faculty and residents. While the granular logistics of EPA implementation will likely differ among programs of varying sizes, structures, and cultures, a united investment from both educators and learners will be universally integral for sustained engagement. Identifying contextual factors specific to one’s program that support a culture dedicated to high-quality feedback, and ideally being informed by both faculty and residents, should be a goal for implementation strategies.

Competency-based education continues to evolve in programs that have already adopted the approach, and likewise, the future of surgical training will be determined by the ABS implementation of EPAs. Our timely study to improve feedback has the potential to advance even further, as adapting practical feedback strategies for EPA assessments can better facilitate resident readiness for independent practice. Our findings should be considered as surgical residency programs embark on this new educational paradigm and begin harmonizing meaningful feedback with a competency-based learning environment.

Study Findings	Practical Implications
Faculty and residents have differing perceptions of feedback	<ul style="list-style-type: none"> - A shared mental model includes clarity on learning objectives, expectations, and the type of feedback needed or desired - Meaningful pre-briefing and debriefing are reliant on transparent two-way conversations - Review of prior experiences (i.e. EPA data) heightens visibility and can drive valuable goals and expectations setting - Residents want feedback that is more elaborate than the SMART framework
Designated time free from competing priorities is challenging though essential	<ul style="list-style-type: none"> - A formalized structure and process encourage dedicated opportunities for productive discussions - Without completely protected time, participating in educational tasks remains overlooked - Informal instances of feedback can still be meaningful - EPAs require a partnership—faculty and resident shared investment in EPA microassessments will mitigate assessment burdens for all
Developmental differences exist between distinct levels of training	<ul style="list-style-type: none"> - Junior and senior residents have different needs and expectations regarding feedback - Junior residents should have feedback encounters outside of the operative environment - Building rapport facilitates mutual trust and higher-quality feedback
Competition is a strong motivating factor	<ul style="list-style-type: none"> - Gamification is a practical approach to increasing engagement - Highlighting low and high performers can prompt people to adjust their behaviors
Sustainable change requires purposeful and persistent efforts	<ul style="list-style-type: none"> - A needs assessment can identify contextual facilitators and barriers to change - Engaging key stakeholders in co-production promotes collaboration and commitment to the mission - Extrinsic and intrinsic factors need to be addressed for implementation and sustained engagement - Targeted programmatic initiatives carried out properly have the potential to generate lasting cultural change

4.4 Future Directions

While several essential aspects of feedback improved after our intervention, much more work is needed to continue addressing the complex challenges associated with feedback processes. Our study represents an initial step in tackling a multidimensional dilemma, and many important directions and areas of research can evolve from our initiative.

Supplementing this study with qualitative investigations would further elucidate our findings and inform new efforts targeted at the complexities of the surgical environment. Further, exploring strategies to ensure sustainability also warrants consideration. Given time constraints, competing priorities, and the surrounding pressures of the learning environment, an approach to feedback that seamlessly integrates into the daily surgical workflow without adding to administrative burdens and work demands would be extremely favorable. Moreover, first-year residents, or those who do not spend as much time regularly in the OR with faculty, have different feedback needs and expectations. Future efforts can define best practices for different levels of training, types of educators and learners, and situational contexts in order to empower directed teaching and feedback for diverse circumstances.

Many strategies to optimize operative teaching, coaching, and feedback delivery have been investigated,^{13-16,47,48} and the substantial impact of high-quality educational opportunities on accelerated learning is undeniable. With the transition to competency-based medical education, the effectiveness of feedback, assessment, and evaluation of resident skills and competencies will be of utmost importance. Competency-based frameworks and mastery learning hinge on timely and meaningful feedback, and enhancing feedback practices will be fundamental to the successful implementation of a competency-based assessment system. Future explorations integrating feedback and assessment of competence—for instance, examining if higher-quality feedback leads

to greater entrustability in the OR—can revolutionize the educational experiences of surgical faculty and residents.

Feedback plays an indispensable role in surgical training. Giving effective feedback in today's surgical learning environment requires a multidimensional skillset. While no single approach fulfills all needs of educators and learners, a multitude of strategies to strengthen feedback processes have been—and will continue to be—explored. It is a never-ending mission to pursue practices that refine, reform, and optimize the delivery of high-quality feedback. Our study is one step forward in this transformative time in the history of surgical education.

4.5 Limitations

This study should be interpreted in the context of its limitations. First, we acknowledge the limitation of our small sample size. We performed a retrospective power analysis that indicated that our study was underpowered and thus less likely to detect significant differences. However, our findings are overall encouraging, and future expansion of the BFR framework to more collaborators on a larger scale would increase statistical power. Next, our survey responses may be subject to selection bias and/or nonresponse bias, as those who are education-oriented may be more inclined to participate in the study and complete the surveys, and vice versa. To address this, repeated reminders were sent to all study participants after the distribution of pre- and post-intervention surveys in order to increase overall response rates. Similarly, gender bias exists in feedback encounters and is likely exacerbated in a historically male-dominated medical specialty.⁴⁹ Though examining the effect of gender on feedback was outside the scope of our study, to reduce nonresponse bias and aim for an even distribution between men and women respondents—while also recognizing the considerably smaller number of women faculty at baseline—increased efforts targeted women faculty to complete the post-intervention survey.

Furthermore, a disproportionate number of postoperative survey responses for the TACS service may not have been captured as TACS cases are frequently performed outside of their standard ORs in emergent situations. Given that postoperative surveys were often accessed by the QR codes on the framework posters located only in the standard ORs, links to the electronic surveys were included in the weekly reminder emails so that participants had easy accessibility to the surveys at any time. Finally, although the postoperative surveys were intended to monitor the ongoing use of the BFR framework and represent instances of feedback delivery, we recognize that there were likely times when the framework was used but the survey was not completed, the framework was not used but the survey was completed, feedback was given but without framework use or survey completion, and so forth. It will be worthwhile for future research to specifically measure framework use distinct from feedback encounters.

4.6 Conclusions

Our study introduced a feedback framework that was purposefully designed and co-produced from the insight of surgical faculty and residents and subsequently investigated its impact on feedback in the operative environment. The BFR framework positively impacted faculty and resident practices and perceptions of feedback, though considerable discrepancies remain. The feedback process is remarkably complex, and future efforts are needed to address and overcome extrinsic and intrinsic pressures of the surgical learning environment that can hinder high-quality, effective feedback. In this era of competency-based medical education and EPA assessments, optimizing feedback practices will be exceptionally valuable in preparing residents to become confident, competent independent surgeons. Our study is an initial spark that will fuel transformative growth in the surgical education community.

Chapter 5: References

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Chapter 6: Appendices

Appendix A. BFR framework poster

Brigham Feedback Revolution

CUSHING

- B Brainstorm**
Review resident experience
Recognize goals
- F Focus**
Recommend focused feedback
- R Recap**
Reflect
Reinforce strengths
Readdress weaknesses
Refine goals

FACULTY **RESIDENT** **STUDENT**

Contact Christine Wu or Stephanie Nitzschke with Qs

cwu12@bwh.harvard.edu
snitzschke@bwh.harvard.edu

Appendix B. Pre-intervention survey for residents

Resident Feedback Pre-Intervention Survey

We are conducting a study investigating faculty and resident perceptions of feedback, and we invite you to be part of this study by completing this survey. When answering the questions below, think about your experiences, on average, over the past 6 months.

Please read and answer each question carefully, as we include items on technical versus non-technical feedback. When thinking about non-technical feedback, consider anything other than operative performance.

Thank you!

Gender
 Female
 Male
 Nonbinary
 Other
 Prefer not to say

PGY level
 PGY1
 PGY2
 PGY3
 PGY4
 PGY5

Do you believe there is a need to improve feedback in our program?
 Yes
 No
 Indifferent

	Almost never	Several times a month	Once a week	Several times a week	Daily
How frequently do you receive TECHNICAL feedback from faculty?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How frequently do you receive NON-TECHNICAL feedback from faculty?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never	Occasionally	Sometimes	Most of the time	Always
How often do you receive TECHNICAL feedback from faculty that is actionable?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often do you receive NON-TECHNICAL feedback from faculty that is actionable?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often do you receive positive feedback from faculty on TECHNICAL skills?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How often do you receive positive feedback from faculty on NON-TECHNICAL skills?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Not at all	Slightly	Moderately	Very	Extremely
How comfortable are you asking faculty for TECHNICAL feedback?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How comfortable are you asking faculty for NON-TECHNICAL feedback?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How satisfied are you with the TECHNICAL feedback you receive from faculty?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How satisfied are you with the NON-TECHNICAL feedback you receive from faculty?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Almost never	Several times a month	Once a week	Several times a week	Daily
How frequently do you and faculty discuss learning objectives before cases?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How frequently do you and faculty debrief after cases?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Which NON-TECHNICAL skills are most important for residents to receive feedback about regularly?

Please describe what you consider to be high-quality, effective feedback. If able, please provide an example of high-quality, effective feedback you have received during residency.

Appendix C. Post-intervention survey for residents

Resident Feedback Post-Intervention Survey

We are conducting a study investigating faculty and resident perceptions of feedback, and we invite you to be part of this study by completing this survey. Thank you for your participation with our prior survey. When answering the questions below, think about your experiences, on average, over the past 6 months.

Please read and answer each question carefully, as we include items on technical versus non-technical feedback. When thinking about non-technical skills, consider anything other than operative performance.

Thank you!

Gender	<input type="radio"/> Female <input type="radio"/> Male <input type="radio"/> Nonbinary <input type="radio"/> Other <input type="radio"/> Prefer not to say
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PGY level	<input type="radio"/> PGY1 <input type="radio"/> PGY2 <input type="radio"/> PGY3 <input type="radio"/> PGY4 <input type="radio"/> PGY5
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Have you noticed a change in the quantity of feedback you receive from faculty?	<input type="radio"/> Increased quantity <input type="radio"/> Decreased quantity <input type="radio"/> No change
---	---

Have you noticed a change in the quality of feedback you receive from faculty?	<input type="radio"/> Better quality <input type="radio"/> Worse quality <input type="radio"/> No change
--	--

	Almost never	Several times a month	Once a week	Several times a week	Daily
How frequently do you receive TECHNICAL feedback from faculty?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How frequently do you receive NON-TECHNICAL feedback from faculty?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never	Occasionally	Sometimes	Most of the time	Always
How often do you receive TECHNICAL feedback from faculty that is actionable?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often do you receive NON-TECHNICAL feedback from faculty that is actionable?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How often do you receive positive feedback from faculty on TECHNICAL skills?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often do you receive positive feedback from faculty on NON-TECHNICAL skills?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Not at all	Slightly	Moderately	Very	Extremely
How comfortable are you asking faculty for TECHNICAL feedback?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How comfortable are you asking faculty for NON-TECHNICAL feedback?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How satisfied are you with the TECHNICAL feedback you receive from faculty?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How satisfied are you with the NON-TECHNICAL feedback you receive from faculty?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Almost never	Several times a month	Once a week	Several times a week	Daily
How frequently do you and faculty discuss learning objectives before cases?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How frequently do you and faculty debrief after cases?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Over the past 6 months, did you rotate on the Cushing or Cutler services?	<input type="radio"/> Yes <input type="radio"/> No				
How frequently did you use the BFR framework for feedback delivery?	<input type="radio"/> Never <input type="radio"/> Occasionally <input type="radio"/> Sometimes <input type="radio"/> Most of the time <input type="radio"/> Always				
How do you feel about the length of time spent between you and faculty when utilizing the BFR framework?	<input type="radio"/> Too much time <input type="radio"/> Just right <input type="radio"/> Too little time				
	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
The BFR framework has helped me identify my areas of strength.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The BFR framework has helped me identify my areas needing improvement.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The BFR framework has promoted more focused feedback specific to my learning needs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The BFR framework has promoted more discussion between the faculty and resident on learning goals and feedback.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The BFR framework is an effective approach to feedback delivery.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will continue to utilize the BFR framework for future cases.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please share what you like about the BFR framework.

Please list any barriers to utilizing the BFR framework.

Additional comments, concerns, or feedback.

Appendix D. Postoperative survey for residents

Page 1

Cushing Resident Feedback

Thank you for accessing the feedback postoperative survey. We hope that use of the BFR framework (Brainstorm, Focus, Recap) encourages collaborative efforts and a shared educational focus among attendings and residents to aim for high-quality, effective feedback all the time.

Please answer the question(s) below.

Thank you!

Did you receive feedback for the case?

- Yes
 No

Is the feedback actionable?

- Yes
 No