

Gaining Insight into Operative Performance

Analysis of an Automated 360-Degree Feedback Tool Among Perioperative Staff

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Background: Surgery has seen limited adoption of 360-degree feedback tools, and no current tools evaluate intraoperative performance from a technical, nontechnical, or teaching skill perspective. We sought to evaluate the overall findings and perceived value of a novel 360-degree feedback tool for surgeons from their operating room colleagues.

Methods: The 'intraoperative 360' (i360) combined 3 previously validated scales of surgeon performance. The electronic medical record at a single academic medical center was queried for perioperative staff involvement in recent cases for a cohort of surgeons. Staff with frequent surgeon case involvement were emailed a link to an anonymous i360 survey. Aggregated survey responses were provided to surgeons and surgical leadership. We performed semi-structured interviews with 10 surgeons and 5 surgical leaders. Combined inductive and deductive coding was used to determine their perceptions regarding the utility of and barriers to the i360.

Results: Over 2-years, a total of 960 surveys were completed for 88 surgeons. The composite rating of technical skills was 4.87/5 (SD: 0.36); nontechnical skills, 4.65/5 (SD: 0.55); and teaching skills, 2.92/3 (SD: 0.24). There was no difference in mean scores based on gender, age, or years of tenure. Six themes emerged from the interviews: initial reactions, utility, additional needs, other feedback mechanisms, reciprocal feedback, and logistical challenges.

Conclusions: A 360-degree feedback tool is feasible, and feedback is perceived as valuable and actionable for surgeons and surgeon leaders. The intraoperative focus provided surgeons with specific feedback on how to improve within the operating room to promote efficiency, teamwork, and patient safety.

Keywords: multisource feedback, nontechnical skills, operative performance, perioperative, teaching, technical skills

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INTRODUCTION

Enhanced surgeon technical and nontechnical skill performance is associated with improved patient outcomes.¹⁻³ Feedback for ongoing professional development is crucial to achieving peak performance, but few mechanisms enable surgeons to achieve accurate assessment.⁴ This is particularly true in the operating room (OR), where it can be difficult to get specific feedback on operative performance following surgical training.

'360-degree' evaluations are utilized across industries to provide performance feedback from key stakeholders.⁵⁻⁷ These surveys leverage direct observation by peers, direct reports, and superiors to provide insights into how an individual is perceived and can improve. Importantly, the regularity and bidirectional nature of these evaluations create a culture of introspection and self-improvement, benefiting each individual and the organization.⁸

The surgical field has seen limited adoption of 360-degree tools. When utilized, these tools typically evaluate patient relationships, diagnostic/treatment skills, collegiality, professionalism, communication, and leadership outside of the OR.⁹ Most of these tools suffer from bias with self-selection of evaluators, and none evaluate intraoperative technical, nontechnical, or teaching skills, which are core to surgical performance and greatly impact patient safety. Very few engage the perspective of OR colleagues. Limited intraoperative performance feedback and lack of engagement of perioperative staff in evaluating areas for performance improvement is a significant gap in the continuing medical education of surgeons.

We sought to evaluate surgeon performance and the perceived value of a novel intraoperative feedback tool for surgeons that leverages the electronic medical record to automate rater identification and obtain specific feedback regarding intraoperative performance. The goal of this work was to evaluate overall surgeon performance on intraoperative technical, nontechnical, and teaching skills from the perspective of the perioperative

staff and to obtain feedback for surgeons on their performance that could be utilized specifically within the operating room. We then wanted to assess surgeon and surgical leader perceptions on the benefit and usefulness of this feedback.

METHODS

Study Design and Context

We conducted this study at a large academic medical center where surgeons undergo 360-degree evaluations during their biannual hospital credentialing. We leveraged this existing 360-degree feedback infrastructure to trial a novel instrument designed to evaluate intraoperative performance in collaboration with Pulse 360, Inc. (Orlando, FL). Ethics approval was granted by the Boston Children's Hospital Human Subjects Research Committee.

Intraoperative Survey Development inconvenience

Three previously validated intraoperative rating scales were combined to develop the 'intraoperative 360' (i360) instrument: objective structured assessment of technical skills,¹⁰ nontechnical skills for surgeons,¹¹⁻¹⁴ and intraoperative teaching skills.¹⁵ There were 7 technical skill questions, 15 for nontechnical skills, and 9 for teaching. The technical skills questions used a 5-point scale with anchors from the objective structured assessment of technical skills framework. The nontechnical skill portion utilized validated questions from prior proprietary surveys to assess the 4 domains of the nontechnical skills for surgeons' taxonomy, with responses ranging from 'not at all' (1) to 'to a very great extent' (5). Finally, the intraoperative teaching assessment form, which leverages a 3-point scale from 'not done at all' (1) to 'frequently done' (3), was used to create the teaching questions. All questions also provided an 'unable to assess' response. An additional free response section enabled feedback on things the attending surgeon should stop, keep, and/or start doing.

Recruitment of Subjects

Division chiefs from all surgical subspecialties were eligible to trial the novel instrument for a surgeon performance review in lieu of the existing 360-degree feedback tool. The names of the surgeons due for evaluation, based on re-credentialing, were provided to the study team. We queried the electronic medical record for perioperative team members (nurses, anesthesiologists, advanced practice providers, scrub technicians, trainees, surgeons, and radiographers) who participated in at least 20 cases with each surgeon over the preceding 12 months. These individuals were invited to serve as raters.

Surgeons were identified for semi-structured interviews via nonprobability, purposive sampling following receipt of i360 feedback to include individuals across the various participating departments. The goal of this sampling method was to ensure diverse participation from multiple departments since some departments have more surgeons and therefore, had more participants. Individuals were identified from October to November 2022 and contacted via email for a virtual interview about their perceptions of the i360. The 5 surgeon leaders with a significant number of surgeons participating were also interviewed.

Data Collection

Eligible operative team members were emailed a unique hyperlink with the i360. The email assured anonymity, offered a brief explanation of the survey purpose, and informed them of their ability to opt out. Responses were aggregated and anonymized before being provided to surgeons and surgeon leaders for performance review purposes.

A semi-structured interview guide was developed by the research team, including 2 attending surgeon leaders, a surgical resident, and investigators experienced in qualitative methods and health services research (Supplemental Appendix 1, <http://links.lww.com/AOSO/A439>). We refined the interview guide iteratively through 2 pilot interviews. All interviews were conducted using a video- and audio-based conferencing platform (Zoom Video Communications, San Jose, CA) and lasted 15 to 30 minutes. Interviews were conducted by 1 study team member (S.J.S.), who had undergone qualitative interview training. The interviewer was a surgical resident completing dedicated academic research time, and she had not spent significant time clinically with any of the interviewed surgeons. After obtaining verbal consent, the audio from each interview was recorded and transcribed. No repeat interviews were conducted nor were recordings/transcripts returned to interviewees for review or comment. Interviews were conducted until thematic saturation, which was based on the frequency with which topics and responses were repeated for the surgeons.¹⁶ All eligible surgical leaders were interviewed.

Outcomes

The primary outcomes were (1) overall performance ratings in technical, nontechnical, and teaching skills and (2) perceived value of the results by surgeons and surgeon leaders based on interviews. Secondary outcomes included quantitative variance in surgeon performance for each domain stratified by surgeon gender, surgeon age (dichotomized at 55 years), and surgeon years of tenure at the institution (dichotomized at 10 years).

Analysis

Descriptive statistics were used for demographics. We performed subgroup comparisons using the Student's *t* test for continuous variables. All quantitative analyses were performed using IBM SPSS Statistics (v29). This was a descriptive qualitative study that used thematic analysis of interview transcripts to interpret meaning from the qualitative data. Thematic analysis was conducted via a combined inductive and deductive approach using Nvivo for coding by 2 study team members (S.J.S. and L.S.).^{17,18} An initial codebook was created deductively and then iteratively refined inductively based on the coding of the first 2 transcripts. Double coding was performed for all interviews to ensure that both coders agreed with the code definitions and there was good agreement (See COREQ Checklist Supplemental Appendix 2, <http://links.lww.com/AOSO/A440>).

RESULTS

Participant and Evaluator Characteristics

Over 2 years, 960 (44% response rate) surveys were completed for 88 surgeons. Evaluations were completed by nurses (362, 37.7%), anesthesiologists (249, 25.9%), advanced practice providers (93, 9.7%), scrub technicians (91, 9.5%), fellows, residents, medical students (64, 6.7%), surgeons (54, 5.6%), other physicians (30, 3.1%), and radiographers (17, 1.8%). There were 61 (69.3%) male surgeons and 27 (30.7%) female surgeons. Most surgeons were either general (21.6%) or orthopedic surgeons (29.5%). Around 56 (63.6%) had tenure for 10+ years and 58 (65.9%) were under age 55. The median number of evaluations completed for each surgeon was 12 (range 3-23) with 60 (68.2%) surgeons having at least 10 evaluations (Table 1).

Quantitative Findings

The overall composite rating of technical skills was 4.87/5 (SD: 0.36), of nontechnical skills was 4.65/5 (SD: 0.55), and of

TABLE 1.
Surgeon Participant Demographics

Demographics	Surgeons (n, %)
Gender	
Male	61 (69.3%)
Female	27 (30.7%)
Age	
<55 years	58 (65.9%)
55+ years	30 (34.1%)
Years of tenure	
<10 years	32 (36.4%)
10+ years	56 (63.6%)
Specialty	
Orthopedics	26 (29.5%)
General surgery	19 (21.6%)
Otolaryngology	11 (12.5%)
Urology	10 (11.4%)
Plastics and oral Surgery	9 (10.2%)
Neurosurgery	8 (9.1%)
Dentistry	5 (5.7%)
Number of completed evaluations	
<10 ratings	28 (31.8%)
10+ ratings	60 (68.2%)

TABLE 2.
Subgroup Analyses of Numerical i360 Scores

Subgroup	NOTSS	OSATS	Teaching Skills
Evaluator role (mean, SD)			
Surgeon (n=54)	4.70/5 (0.51)	4.74/5 (0.51)	2.92/3 (0.19)
Anesthesiologist (n=249)	4.71/5 (0.50)	4.91/5 (0.33)	2.95/3 (0.18)
Other physicians (n=30)	4.82/5 (0.27)	4.91/5 (0.26)	2.97/3 (0.09)
Trainee (n=64)	4.75/5 (0.53)	4.90/5 (0.25)	2.89/3 (0.37)
APP (n=93)	4.48/5 (0.61)	4.83/5 (0.44)	2.87/3 (0.30)
Nurse (n=362)	4.64/5 (0.57)	4.89/5 (0.32)	2.92/3 (0.24)
Scrub techs (n=91)	4.52/5 (0.60)	4.79/5 (0.43)	2.91/3 (0.22)
Radiographer (n=17)	4.80/5 (0.43)	4.82/5 (0.43)	2.93/3 (0.19)
Gender (mean, SD)			
Female	4.70/5 (0.27)	4.87/5 (0.14)	2.93/3 (0.09)
Male	4.61/5 (0.32)	4.84/5 (0.26)	2.91/3 (0.14)
P value	0.173	0.558	0.483
Age (mean, SD)			
<55 years	4.67/5 (0.23)	4.87/5 (0.16)	2.93/3 (0.08)
55+ years	4.57/5 (0.41)	4.81/5 (0.32)	2.88/3 (0.19)
P value	0.117	0.226	0.151
Years of tenure (mean, SD)			
<10 years	4.66/5 (0.26)	4.83/5 (0.18)	2.92/3 (0.10)
10+ years	4.62/5 (0.33)	4.86/5 (0.25)	2.91/3 (0.14)
P value	0.522	0.656	0.581

APP indicates advanced practice providers; NOTSS, nontechnical skills for surgeons; OSATS, objective structured assessment of technical skills.

Teaching skills based on work by Torbeck and Dunnington.

teaching skills was 2.92/3 (SD: 0.24). When analyzed by gender, age, and years of tenure, there was no significant difference in the ratings (Table 2).

Perceptions of i360 from Surgeons and Surgeon Leaders

Ten of the 21 surgeons contacted were interviewed. The 11 surgeons not interviewed either did not respond or were unable to schedule the interview. Of the 10 surgeons interviewed, 3 (30%) were general surgery, 3 (30%) orthopedics, 2 (20%) dentistry, 1 (10%) otolaryngology, and 1 (10%) urology. An additional 5 surgeon leaders were interviewed from plastic and reconstructive surgery, otolaryngology, dentistry, general surgery, and orthopedics. Overall, we interviewed 11 (73.3%) male and 4 (26.7%) female surgeons, consistent with the overall cohort

gender distribution. Six themes emerged: initial reactions, utility, additional needs, other feedback mechanisms, reciprocal feedback, and logistical challenges. Within these 6 themes, there were 15 subthemes. Supplemental Table 1, <http://links.lww.com/AOSO/A441> shows representative quotes.

Initial Reactions

Surgeon and surgeon leader initial reactions to the evaluation and the feedback received were mostly positive, with a few negative or neutral reactions. Positive reactions highlighted that feedback was specific to the OR, making it helpful and more relevant, that the feedback received was positive overall, and the evaluations provided objective feedback for surgeon leaders. Surgeons also mentioned the benefit of getting feedback on different aspects of surgical skill (technical and nontechnical skills). For example, surgeon 3 said, “I had no idea you were going to do these questions. I had no idea this is what I was being assessed on. I love that because I think it’s great and long overdue.” Surgeon leaders reported the evaluations provided them with necessary, objective feedback on the surgeons: “Not that the results were especially surprising, but they provided some objective data in an anonymous fashion that then I could give feedback on.” Negative reactions focused on initial concerns that the feedback would be all negative or that evaluators would be unable to accurately assess the skills being evaluated.

Utility

Subthemes within utility of the evaluation and feedback received included most useful aspects, least useful aspects, and likely uses or already implemented practice changes.

Specificity was deemed most useful by surgeons and surgeon leaders. Many reported that when the comments provided were specific, they were more actionable: “Within some of those comments, there are specific items or specific things that people notice, and that is helpful to you.” Multiple surgeons mentioned the OR focus helped put the feedback into perspective and provided concrete areas to enhance performance: “Because this is more focused for the OR, there was 1 particular piece of feedback about communication that is probably less applicable in other settings and was able to be identified for this particular process.” They emphasized that the OR is an essential aspect of a surgeon’s practice, making the feedback more valuable and relevant: “This was more specifically OR feedback, and as a surgeon, that’s where our stock and trade is.”

Many identified that constructive or negative comments were helpful because they provided concrete actions to be addressed: “Most useful is the negative stuff, the things you need to improve. For surgeons, that’s what we want.” Some subjects mentioned the i360 provided them insights into how they were perceived by others: “I’ve learned over the years that how you perceive yourself can be quite different as to how other people perceive you. Being able to understand that better and also how people’s perspectives are very different is very helpful. People don’t always see situations or events through the same lens. So being self-aware of how other people’s perspectives are very different is, in general, very helpful.”

Interviewees felt the numerical scores and less detailed or overly positive comments were less helpful. A few reported the numerical scores lacked utility because they did not have prior scores on those metrics and because the scores were relatively high overall: “You can’t say I got a 4.8, but I really want to get a 4.9. That’s my goal. That’s not an actionable kind of feedback.” Furthermore, many surgeons noted that overly positive comments did not provide areas for improvement: “I mean though it’s nice when people say nice things, in general, when they are not specific about areas for improvement, that’s the least helpful.”

Many surgeons reported that feedback allowed them to make practice changes in the OR to improve the team environment. One said, “The feedback was related to communication in the OR and I like to think that I have been practicing that since I got it.” The most frequently mentioned feedback topic and practice change was communication in the OR. Specific examples of practice changes instituted include: discussing all equipment needs at the start of each case or the day, being conscious of tone of voice, and attempting to reduce interruptions.

Most surgical leaders also felt the i360 provided them with additional data points that complemented other feedback mechanisms, such as personal observations or other reporting systems. This allowed them to get a better idea of potential issues with faculty and address any problems: “It’s helpful because it’s good for people to realize how they’re viewed by others. It’s good to have other people to be able to say, the nurses are seeing this, the anesthesiologists are seeing this. I think it does make them change.” Some leaders mentioned the feedback allowed them to get coaches for surgeons with more negative feedback and this aided with behavior changes.

Additional Needs

Surgeons and leaders did identify 2 areas where the i360 could be expanded. They expressed a desire for more feedback from trainees and surgical colleagues, as well as the need for frequent reevaluation and expansion of the i360 to ensure that necessary changes are implemented. Interviewees felt it was helpful to get perioperative team feedback, but that since technical, nontechnical, and teaching skills were being assessed, it would be helpful to get more feedback from other surgeons, particularly trainees: “I felt there may be a dearth of feedback from the trainees. I don’t know whether that’s the case, but I didn’t sense that I was getting that kind of feedback.” A few mentioned that it would be helpful to build in a method, such as surgical coaching, to assist surgeons with practice changes based on the feedback: “I would just encourage you guys to expand it and to have some sort of recurring theme, every 2 years, or something, just so that it’s not onerous, but then have a way for folks to act on it in terms of coaching, etc.”

Reciprocal Feedback

Surgeons were asked about the perceived benefits of providing reciprocal feedback to perioperative staff members and had conflicting views on the utility of such feedback. Many reported that reciprocal feedback could create a culture of improvement within the entire team, allow surgeons to provide feedback in a structured way, and ultimately improve patient safety: “In the OR, there’s always a big power dynamic, and it’s actually a safety issue. Because depending on the culture of the OR, sometimes nurses are afraid of speaking up. So I think that’ll be useful.” However, a few surgeons acknowledged there is less of an educational contract with perioperative staff members who are not trainees and that the hierarchy that exists between different roles should be considered: “I think that might be useful, although it’s always a little bit more sensitive when you’re talking about giving feedback to people who are lower on the power gradient if you want to put it that way. It has to be done the right way. It’s similar to giving feedback to your direct reports and people are much more sensitive to that kind of feedback. It would have to be done well.”

Logistical Challenges

There were some logistical challenges with administering the i360 and with the feedback received. For instance, surgeons who spent less time in the OR had fewer evaluations and, therefore, less robust feedback. Notable subthemes within logistical

challenges were concerns about the evaluators chosen, the ability of the evaluators to assess the surgeons, frequent team turnover limiting familiarity, and overall survey fatigue reducing the number of responses.

Some reported a lack of transparency regarding evaluator choice, as prior iterations of 360s allowed the surgeon to choose their own evaluators. The objective selection of evaluators for the i360 without surgeon or surgical leader input led to some apprehension and confusion about how selection took place: “I did not know how the people that were on the survey were chosen. Sometimes when we do 360, we’re told you could choose some, and your chief or your supervisor will choose others.” In addition, a few discussed concerns that nonsurgeon evaluators would not be able to accurately assess technical surgical skill. Others mentioned that there is significant OR team turnover currently with staffing issues and traveling nurses and that this may impact the validity and usefulness of the feedback collected.

DISCUSSION

We found the i360 provides relevant, actionable feedback for surgeons and surgeon leaders. Overall, the i360 numerical scores were high in technical, nontechnical, and teaching skills. We saw no differences in scores based on surgeon gender, age, or years of tenure. Qualitative interviews with participant surgeons and surgeon leaders demonstrated that the comment section provides the most useful feedback. At the time of our qualitative interviews, many surgeons were planning or had already instituted practice changes based on this feedback. There was a desire to evaluate the i360 process iteratively to ensure that it meets the ongoing needs of surgeons and surgeon leaders while combating logistical issues with staffing changes and survey fatigue.

Prior work demonstrated that 360s provide useful and accurate feedback for clinicians, including surgeons, and division leadership.^{4,9,19,20} However, prior 360s were broader than this OR-focused i360. By narrowing the scope of the feedback, the i360 allows surgeons to obtain feedback pertinent to the OR and implement practice changes to enhance operative performance. Hageman et al¹⁹ found that 360-degree scores from coworkers correlated with physician-patient satisfaction scores, and Lagoo et al²⁰ found that surgeons with low scores on specific 360-degree questions had higher numbers of malpractice claims than their surgical colleagues with higher scores. Both of these studies highlight the utility of 360-degree feedback, but this feedback must be implemented into practice to result in change. The i360 provides surgeons with the necessary context and specificity to make implementation of these intraoperative changes feasible.

Teamwork within the OR is vital to patient safety. An evaluation of surgical malpractice claims involving communication breakdowns found that the majority involved verbal communication issues with the attending surgeon and another perioperative team member.²¹ In our study, surgeons reported that a significant portion of their feedback related to communication, and this formed the basis of many instituted practice changes. Mazzocco et al²² found that when surgical teams demonstrated team behaviors less often, patients were more likely to have a major complication, including death. In our study, perioperative staff members often provided feedback that would enhance teamwork and collaborative behaviors within the OR, and surgeons felt that being able to provide reciprocal feedback would lead to a culture of improvement for the entire team. The anonymous nature of the evaluation helps to mitigate concerns regarding providing feedback up the hierarchy and gives perioperative team members a psychologically safe avenue to give critical feedback. Given the seriousness of the implications of poor communication and teamwork, the i360 feedback can serve as an important proactive intervention to prevent patient harm.

Study limitations included this was a single institution study with a culture of regularly conducted 360s. Staff were familiar

with the process and leadership buy-in was already present. This may limit generalizability. We intentionally tested this novel 360 and its perceived value using targeted interviews of surgeon participants. A comprehensive evaluation process involving all participants may have revealed nuances regarding perceptions, at the cost of being more invasive. Moreover, behavior change could only be assessed with surgeon-reported changes from interviews as independently observed behavior change was not within the study scope. The overall completion rate of evaluations was modest, but we had broad representation from many OR groups. Some surgeons received more evaluations, which may have skewed our results. The operative focus omits feedback on other aspects of clinical care, which affects surgeons who have less OR time. This focus was purposeful to provide surgeons with specific feedback in an arena where it can be difficult to obtain and where peak performance is critical. Finally, there may have been selection bias in those who agreed to qualitative interviews. Nonetheless, thematic saturation was reached after 10 surgeon interviews, and further attempts to contact/schedule interviews were not pursued. All surgeon leaders with significant evaluated staff were interviewed to mitigate selection bias within this group. Interviews were designed to be short to encourage surgeon participation, but this limited more comprehensive probing and more robust thematic analysis.

Future directions include longitudinal data collection, allowing for objective assessment of subsequent behavior change. Dedicated educational interventions have been found to lead to improved subsequent 360-degree scores,²³ and some surgeons in our study expressed an interest in linking the feedback to surgical coaching to assist them with performance improvement. This could allow surgeons to institute practice changes more quickly and more frequently reassess their progress.

CONCLUSIONS

An OR-focused 360-degree feedback tool was perceived as valuable and provided actionable feedback for surgeons and surgeon leaders. The feedback identified concrete areas for improvement within the OR, and many surgeons reported instituting practice changes. Surgical leaders felt the evaluations supplied them with additional objective feedback to encourage necessary behavior changes. The i360 is a worthwhile tool to enhance operative performance and should be linked to structured interventions to promote OR teamwork and patient safety.

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