Do Resident's Leadership Skills Relate to Ratings of Technical Skill?

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Abstract

Introduction:

This study sought to compare general surgery research residents' survey information regarding self-efficacy ratings to their observed performance during a simulated small bowel repair. Their observed performance ratings were based on their leadership skills in directing their assistant.

Methods:

Participants were given 15 minutes to perform a bowel repair using bovine intestines with standardized injuries. Operative assistants were assigned to help assist with the repair. Prior to the procedure, participants were asked to rate their expected skills decay, task difficulty, and confidence in addressing the small bowel injury. Interactions were coded to identify the number of instructions given by the participants to the assistant during the repair. Statistical analyses assessed the relationship between the number of directional instructions and participants' perceptions self-efficacy measures. Directional instructions were defined as any dialogue by the participant that guided the assistant to perform an action.

Results:

Thirty-six residents (58.3% female) participated in the study. Participants who rated lower levels of decay in their intra-operative decision-making and small bowel repair skills were noted to utilize their assistant more by giving more instructions. Similarly, a higher number of instructions correlated with lower perceived difficulty in selecting the correct suture, suture pattern, and completing the entire surgical task.

Conclusion:

General surgery research residents' intra-operative leadership skills showed significant correlations to their perceptions of skill decay and task difficulty during a bowel repair. Evaluating resident's directional instructions may provide an additional individualized intra-operative assessment metric. Further evaluation relating to operative performance outcomes is warranted.

Keywords: Non-technical skill, Technical skill, Simulation, Education, Bowel repair

1. Introduction

Success in the operating room (OR) has most often been attributed solely to technical ability. Presently, non-technical skills are being recognized as contributing to operative success [1]. Non-technical skills are defined as the cognitive and interpersonal skills that reinforce a surgeon's technical ability that help contribute to safe practice and successful surgical outcomes [2]. A surgeon's skill directing others in the OR may be as critical to a patient's surgical outcome as their skills with a scalpel [3]. Emphasized training in these non-technical skills have shown to benefit OR performance in a variety of ways [1]. The observational teamwork assessment for surgery (OTAS) showed that increased teamwork development lead to fewer adverse events during surgery [4]. Similar results were found in a review of communication skills and error frequency [5]. Improved communication and leadership amongst those on a surgical team increases effectiveness in the operating room by decreasing operative time and improving patient safety [6-9].

While it may seem that non-technical skills are only complementary to technical skills, clinical residency training should also focus on teaching non-technical skills because of the benefits demonstrated intra-operatively [4-9]. However, non-technical skills can be harder to assess [10] and are commonly minimized in training [11]. In these cases, training using simulation is a feasible option to teach non-technical skills that may lie outside the typical clinical environment [12] or are considered too risky for practice on patients [13]. Surgical simulation has also been used for assessments in decision-making [14], error training and management [15], measuring operative independence [16] and resident readiness for the operating room [16]. During post-simulation training, residents expressed that simulation training helped minimize skills decay and maintain confidence during time away from clinical training for dedicated research [17]. Further results showed that resident ratings of confidence and skill independence increased following simulation training [18]. More generally, Campbell et al. (2011) found that simulation training led to an increase in both surgical performance and self-efficacy measures [19].

Ongoing work in our laboratory employing discourse analysis suggests that communication patterns between a surgeon and operative assistant are strongly associated with technical skills. Additional results showed that discourse analysis may provide important insight on surgical ability and competence. In a simulated laparoscopic ventral hernia (LVH) repair, senior surgical resident communication with their operative assistant was coded into two categories: giving instructions and asking questions [20]. Discourse analysis showed that giving the operative assistant instructions was an important element of performance and was linked to higher scores in final product analysis. Although this study controlled for individual differences in discourse, it did not evaluate participants' self-efficacy or how self-efficacy may relate to providing directional instruction to operative assistants.

In the present study, measures of participant's self-efficacy in their technical (small bowel repair) skills and non-technical skills (operative leadership) were included. Breaking down operative leadership further, we look specifically at how these leadership skills show through as the participants directs their operative assistant during the surgical task. We believe that this indirectly relates to the level of knowledge of the trainee and their leadership skills, as 'use of assistant' has been a validated topic included in the OSATS assessment form. These measures give an additional layer to the objective assessment of performance, and provide context regarding participant's behaviors and whether they are indicative of subjective skill perception.

The aim of this study was to understand research residents' non-technical leadership skills as they compare to their self-perceptions of technical and non-technical skill decay, task difficulty, and confidence in the necessary procedural steps for repairing a small bowel. Operative leadership was defined as the participant's ability to give directional instructions to an operative assistant during the

procedure. We defined directional instruction to be any dialogue by the participant that guided the assistant to perform an action. Our goal is to assess the utility of ‘giving instructions’ as a useful performance metric, and to understand if this performance metric has any relation to self-assessments of technical skill. We hypothesized that participants’ expectations for skill decay, difficulty, and confidence in their repair would correlate to their ability to give directional instruction to the operative assistant during a simulated small bowel repair.

2. Methods

2.1 Population

This study included 40 (57.5% female) general surgery residents (PGY 2-5) in dedicated research. Four participants were excluded due to incomplete data. The remaining 36 participants (58.3% female) were being trained in six programs across the Midwest. This study was part of a larger, longitudinal multi-procedure investigation aimed at identifying surgical skills that degrade over periods of nonuse. The University of Wisconsin Hospitals and Clinics (UWHC) Institutional Review Board approved this study.

2.2 Pre-participant survey

Participants were first given a survey to collect general demographic information on their training and experience [16]. The survey asked participants to rate their perception of surgical skillset reduction related to intra-operative decision-making, and small bowel repair skills using a 5-point Likert scale (1=no reduction, 5=very large reduction). Participants were then asked to rate their perceived difficulty (1=not difficult, 5=extremely difficult) in completing three procedural steps of a small bowel repair which included: selecting the correct suture type, suture pattern, and successfully performing the entire surgical task. The survey also asked participants to rate their confidence (1=not confident, 5= extremely confident) in these same procedural skills.

2.3 Research protocol

Participants were presented with a simulated scenario of a patient with multiple gunshot wounds to the abdomen. Participants were asked to locate, inspect and repair the injured portion of bovine small bowel. The injury contained a small and large enterotomy to the anti-mesenteric portion of the small bowel. The injuries were located close in proximity but differed in size and character. The larger injury (1x1 cm) was simulated to have jagged edges, while the smaller injury (0.5x0.5 cm) was made to have cleaner edges. Participants were given 15 minutes to complete their repair. Audio and video data were recorded during each participant’s performance

2.4 Instruments

Participants were given access to all necessary surgical instruments to repair the injuries with the exception of stapling devices and electrocautery. In addition, they were given the choice of five different types of 3-0 suture. A researcher served as an operative assistant and was considered to be at the level of a medical student. This assistant was instructed to give scripted responses to clarify study expectations of the participant, however they were restricted from providing feedback to assist with the participant’s repair.

2.5 Discourse analysis

Operative leadership was assessed using the number of directional instructions the participant provided to their operative assistant during their 15-minute repair. Coding was conducted by a single, blinded independent observer and was grounded in the leadership language used by two commonly cited team surveys: 1) NOTSS (Non-Technical Skills for Surgeons) and 2) NOTECHS (Non-technical skills) [21, 22]. The observer coded all the directional instructions that each participant provided to the operative assistants. ‘*Directional instruction*’ represented those instances when the participant guided the operative assistant to perform a specific task or motion. These instructions generally fell into two broad categories;

either direction for an instrument, or direction for motion. An example of a direction for an instrument was, “Can I get a pickup please, without teeth?” while an example for direction of motion was, “Alright so I want you to cut near the bowel over here but not into the bowel.”

2.6 Data analysis

Using SPSS 23, correlations were performed between the number of directional instructions given to the operative assistant and participants’ pre-procedure ratings of skill reduction, difficulty, and confidence.

3. Results

3.1 Population

Participants in this study were, on average, 8.27 months into their dedicated research time (SD=8.91) [FIGURE 1]. More than half of the participants (56.8%) were in their first four months at the time of the study, while some (10.8%) had already completed more than two years of research.

3.2 Discourse Analysis

Participants gave between 3-45 directional instructions to their operative assistant throughout the 15-minute repair [FIGURE 2]. On average, the participants gave their operative assistants 16 directional instructions (SD=10.88). Most participants (86%) gave between 3-30 instructions.

3.3 Pre-participant survey

3.3.1 Perception in surgical skillset decay

Our results revealed a trend between the number of instructions and decay in decision-making skills. Specifically, those who gave a higher number of instructions anticipated less reduction in their decision-making skills ($r(38) = -.335$, $p = .055$) [FIGURE 3]. Participants’ who gave a larger number of directions to their assistant perceived a lower reduction in their small bowel repair skills ($r(38) = -.397$, $p = .017$) [FIGURE 3].

3.3.2 Perceived difficulty

A correlation was found between number of directional instructions given to the assistant and perceived difficulty ratings in all three components of the procedure. This relationship revealed that the participants who provided more instructions to their assistant perceived less difficulty in selecting the correct suture, selecting the correct suturing pattern, and performing the entire small bowel repair (suture $r(35) = -.422$, $p = .012$; suturing pattern $r(35) = -.495$, $p = .002$; entire surgical procedure $r(35) = -.403$, $p = .016$) [FIGURE 4].

3.3.3 Confidence

There was no relationship between confidence and number of directional instructions given by the participant to the assistant during the repair ($r(38) = .137$, $p = .426$).

4. Discussion

Residents who were taking time away from clinical training to participate in research were given a survey to rate their self-efficacy measures regarding both technical and non-technical skills related to a small bowel repair. This study focused on participants’ operative leadership skills with respect to skill decay, task difficulty, and confidence. Operative leadership was assessed using the number of directional instructions the participant provided to their operative assistant during their 15-minute repair.

Results showed that residents who gave more direction, via a higher number of instructions, expected to have less decay in both small bowel repair and intra-operative decision-making skills. Specifically, participants who gave more instruction to their assistant tended to rate their reduction in intra-operative

decision-making skills as having only mildly reduced. Likewise, those participants who were able provide more direction to their assistant were significantly less concerned with their perceptions of decay regarding their small bowel repair skills.

In procedural steps related to the bowel repair, residents who provided more direction to their operative assistant rated significantly lower difficulty in all steps related to the repair. These steps included selecting the correct suture, selecting the correct suturing pattern and completing the entire small bowel repair. Higher difficulty ratings in these procedural steps were correlated with reduced operative leadership skills in directing their assistant to help during the bowel repair.

When assessing how participants rated their confidence in these specific technical and non-technical skills, there was no relationship between self-efficacy ratings and the number of directional instructions given. A likely explanation for this finding is that participants did not feel a change in their confidence during their time away for research. In addition, more than half of the participants had only been away from clinical training for four months or less. This discrepancy in our findings may show that blinded observer ratings of a small component of non-technical skills such as leadership, may be a more sensitive indicator of performance than self-ratings. As this study was part of a larger longitudinal study, future analysis of participants who choose to complete the study again will afford us the ability to reassess their confidence after spending more time in the laboratory, away from clinical training.

Two of the most commonly used assessment tools for measuring non-technical skills include NOTSS and NOTECHS [21, 22]. A limitation in using these tools for our study is that we had a very scripted, limited team interaction. There was one surgeon and one assistant and, the assistant was instructed not to give guidance or suggestions to the surgeon. This limited and structured interaction as well as the time limitation of 15 minutes did not provide sufficient context to fully evaluate participants in the team environment. While NOTSS is best for assessing individual team members, we note that both assessments include a leadership anchor. NOTSS focuses on “supporting others” and “coping with pressure”. NOTECHS focuses on how much the leader involves other team members in the course of action. Given our study constraints, we evaluated a small component of operative leadership—providing direction to an operative assistant. This was measured using the number of instructions given and then compared to participants’ self-efficacy ratings. Analysis showed a correlation between the non-technical components of intra-operative decision-making and participant’s perceptions of technical skill decay and difficulty. As such non-technical skills may be a useful indicator of overall operative skill. In addition, trainee instruction in leadership and non-technical skills may facilitate learning and or execution of technical tasks.

While it remains unclear which step is more critical to develop first, studies show that leadership and communication skills may enhance other technical skills. In a study looking at non-technical skills in the OR, Parker et al. (2012) identified guiding and supporting as the most frequent operating leadership behavior, followed by communicating, coordinating, task management, and decision making [23]. Avenues that have been used to develop such non-technical skills includes increased teaching opportunities [24], OR coaching experiences [2], as well as training that focuses on teaching interpersonal [25], and communication skills [26]. As evident by our results, increasing these non-technical skills may simultaneously show benefits of increased technical skill.

In summary, the largest limitation of the current study is the lack of ability to use a well-known and validated tool for measuring non-technical skill. Our central aim was to validate a specific component of non-technical skill on an individual level as this was shown to be important in prior studies in our lab in a different setting [20]. A second limitation of this study was assessment of very few technical (bowel repair skills) and non-technical skills (operative leadership and decision-making). We acknowledge that these skills represent only a small minority of the extensive skills required of general surgery residents.

Further limitations included a lack of formal measurement and control of the amount of talking for each participant as this could influence the number of instructions the participant might have given their assistant.

5. Conclusion

Our results support the use of directional instructions as a potential metric to evaluate intra-operative leadership skills. Non-technical skills training during residency could lead to enhanced skill level, thus improvement in the metrics that are available for assessing leadership skills is warranted. Simulation based training has been a useful tool for incorporating testing, training, and improvement in both technical and non-technical skills. Future work will involve evaluating the relationship between directional instructions and hands-on procedural skills. To accomplish this, our laboratory is developing a validated grading system for final product score of the bowel repair, so we can related the non-technical skill of directing to the technical skills required during the repair.

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Figures Legend:

- 1) The number of months participants had spent in dedicated research at the time of collection
- 2) The number of directional instructions participants gave their operative assistants during the simulated small bowel repair
- 3) The number of instructions given by participants relating to ratings of perceived reduction in: (A) intra-operative decision making skills identified as a trend, and (B) bowel repair skills identified as a significant negative correlation.
- 4) The number of instructions given by participants relating to perceived difficulty ratings in: (A) selecting the correct suture type, (B) selecting the correct suturing pattern, and (C) completing the entire small bowel repair all identified as significant negative correlations.

Figure 1

Figure 2

Figure 3

Figure 4