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A taxonomy of perioperative surgical learning: Trending resident skill acquisition

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ABSTRACT

Background: Resident and curriculum evaluation require tracking surgical resident operative performance, yet what and when to measure remains unclear.
Methods: From a multi-institutional database, we reviewed 611 resident/surgeon-paired assessments of ACGME Milestones and modified OPRS ratings for different cases and postgraduate years.
Results: Faculty Milestone ratings increased with each PGY ($p=<0.001$) and correlated with resident self-ratings (ICC = 0.83). Mean OPRS scores increased in small increments with substantial intra-year variability. Progression among individual OPRS subcategories was not apparent from more global analyses. Interestingly, male faculty offered lower ratings than female faculty.
Conclusions: Milestones and modified mean OPRS ratings suggest residents are learning, yet lack sufficient discrimination for promotion or curricular analysis. Differential progression through OPRS subcategories suggests a taxonomy of surgical learning that can be tailored to focus on different skills at each point in the training continuum. The effect of faculty gender on resident ratings awaits further study.

1. Introduction

Although advances in technology, knowledge, regulatory oversight and public expectations pose increasing demands on surgical learners, general surgery training remains five years long. Educators have sought curricular and assessment methods to best impart to trainees the necessary knowledge, skills, and attitudes required of a successful surgeon.[1,2] The ability to track and trend resident performance using valid and reliable measures that accurately demonstrate progress is fundamental to contemporary resident instruction. Unfortunately, we lack a clear taxonomy of what and when to measure as residents progress.

Sociocultural theory describes "scaffolding" as a strategy for instructors to provide the supports necessary to facilitate progressive learner development.[3,4] Scaffolding builds on prior knowledge, and instruction is provided just beyond the level at which a learner can perform independently.[5] Repeated scaffolding advances the learner to the next stage and assists them to internalize new information. Scaffolds are temporary and the teacher progressively withdraws the support as learner abilities increase,

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individualizing such progressions to each learner.[6] This concept of scaffolding may be particularly helpful when complex tasks are taught in a complex learning environment, as in the operating room. In today's operative training environment residents must focus on whole tasks, taught by combinations of educational approaches, including the apprenticeship model, simulation, competency-based education and problem-based learning.[7] Overwhelming task complexity may sometimes impede resident learning.

Recent changes in resident training oversight have attempted to address these concerns.[8] The General Surgery Milestones Project offers a global framework for faculty surgeons to assess residents across six core-competencies and sub-competencies, describing the knowledge, skills and attitudes necessary for each resident to demonstrate as they progress through training.[8] In general, the Milestones describe global congruent learning expectations for residents to achieve as they progress through training. Following Milestones, the American Board of Surgery requires program directors to attest that a minimum of six operative performance assessments have been completed annually for each resident.[9] The Operative Performance Rating System (OPRS) includes a set of validated, procedure-specific evaluations, offering a range of ratings to assess skill acquisition.[10] As described, however, these assessments were not intended for the purpose of tracking or trending resident performance across the five-year continuum, because of the difficulty of comparing an intern's OPRS rating on a simple procedures such as a herniorrhaphy, to a senior resident's OPRS rating while performing a complex operation such as pancreaticoduodenectomy.

To better address these issues, we conducted a multi-center study using the Michigan State University Guided Operative Assessment and Leaning Consortium (MSU GOAL) database, that employs web-based platform to collect Milestone and generic components of the OPRS assessments. We conducted perioperative educational briefings and debriefings,[11,12] encouraging participation at all resident levels to determine whether significant rating differences could be observed between all post-graduate years (PGY). Because the procedure-specific OPRS assessments were not originally designed to evaluate junior residents or measure progression, we applied a modified version of the OPRS criteria to our briefings and debriefings. To better understand how modified OPRS ratings could be used, we included all operative procedures in order to offer more continuous feedback with adequate time and opportunity to improve. We hypothesized that faculty ratings of resident performance on both the Milestone and modified OPRS rating scales would demonstrate step-wise improvements for each PGY of training and allow us to track and trend resident progress.

We asked teaching surgeons and trainees to independently record Milestone and generic OPRS ratings of trainee performance after the postoperative debriefing, which included immediate feedback between surgeons and residents. We hypothesized that resident Milestone and OPRS self-ratings would resemble those by their faculty surgeon mentors, suggesting agreement about the meaning of these scales and their applicability to each resident's individual performance.

2. Methods

2.1. Study participants

An invitation was extended to interested United States surgery residency training programs to consider participation in an Institutional Review Board (IRB) approved multi-center study. Individual MSU residents and faculty surgeons working within the Sparrow-Lansing and McLaren-Flint Hospital Systems added five programs (Thomas Jefferson, Allegiance Health – an osteopathic training program, Emory University, Santa Barbara Cottage Hospital, and MSU/Sparrow Obstetrics and Gynecology [OB/GYN] and Reproductive Biology) to form the MSU GOAL consortium. We sought to include a variety of procedural teaching specialties, with the inclusion of the OB/GYN program, described by the American College of Surgeons as a surgical specialty.[13] After agreeing to participate, each site identified key team members and respective IRB approvals were obtained. Consent was obtained from each willing participant with the understanding that individual resident Milestone and modified OPRS ratings would be reported to respective program leadership to aid sites in collecting performance data required by accrediting organizations. Only aggregate data reports were to be provided to the study-at-large. Training sessions were conducted for faculty and residents at each site based on requested needs and included formal presentations, demonstrations and role-playing exercises. Access to the online evaluation tool was granted to participants after a registration process where individualized password-protected accounts were established. Monthly teleconferences were then held with site leadership to review results, exchange ideas and consider site-specific recommendations to advance the initiative.

2.2. Study design

A select team of MSU surgical faculty, residents, educators and a computer engineer designed a web-based platform to collect Milestone and modified OPRS ratings for operative procedures performed by surgical faculty and residents. The web-based platform was piloted for three months to allow iterative changes such that assessments could be completed within two to three minutes per entry. Design included compatibility with multiple web browsers, various operating systems and mobile phones, thus enabling data entry to occur from the vast majority of devices or locations with Internet accessibility. MSU IRB approval for exempt status was obtained and data collection efforts began in July 2014.

To submit an assessment, the attending surgeon and resident held a preoperative discussion to agree upon the resident's learning objective, then verbally debriefed on the resident's operative performance immediately after the procedure, as a means of providing direct and formative feedback, as previously described.[12] Each participant then independently completed an online evaluation of demographic and case specific data including resident PGY level of training, the type of case performed (e.g., inguinal hernia), date of service, as well as patient age and gender. Completed evaluations were electronically submitted to a central repository at MSU for analysis. Case-specific data were later used to match resident and surgical faculty entries. Once the match was made, dates were converted to months to further preserve anonymity.

Key data points were collected using a Likert scale of 1–5 for both Milestones (Table 1) and each of the OPRS categories: Instrument Handling, Respect for Tissue, Time and Motion, Operation Flow, Case Difficulty, and Degree of Direction. Paraphrased descriptions of the generalized ACGME Milestones[1] were developed to accommodate the mobile/handheld format. For OPRS categories, descriptive prompts for the behavioral anchors at the 1 (poor), 3 (good) and 5 (excellent) positions on the Likert scale appeared upon mouse-over of the numbers. We constructed a summative OPRS rating called "Mean OPRS" as the average of Instrument Handling, Respect for Tissue, Time and Motion, Operation Flow, and Degree of Direction. Case Difficulty was excluded from the Mean OPRS, as we felt it to reflect the nature of the particular case and not the resident's operative ability. Modified OPRS ratings were also evaluated for item-to-item variation similar to previous work.[14] Based on our findings (not shown) of increased variability among