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Entrustable Professional Activities in Surgery
A Review

Kelsey B. Montgomery, MD; John D. Mellinger, MD; Brenessa Lindeman, MD, MEHP

IMPORTANCE Entrustable professional activities (EPAs) compose a competency-based education (CBE) assessment framework that has been increasingly adopted across medical specialties as a workplace-based assessment tool. EPAs focus on directly observed behaviors to determine the level of entrustment a trainee has for a given activity of that specialty. In this narrative review, we highlight the rationale for EPAs in general surgery, describe current evidence supporting their use, and outline some of the practical considerations for EPAs among residency programs, faculty, and trainees.

OBSERVATIONS An expanding evidence base for EPAs in general surgery has provided moderate validity evidence for their use as well as practical recommendations for implementation across residency programs. Challenges to EPA use include garnering buy-in from individual faculty and residents to complete EPA microassessments and engage in timely, specific feedback after a case or clinical encounter. When successfully integrated into a program's workflow, EPAs can provide a more accurate picture of residents' competence for a fundamental surgical task or activity compared with other assessment methods.

CONCLUSIONS AND RELEVANCE EPAs represent the next significant shift in the evaluation of general surgery residents as part of the overarching progression toward CBE among all US residency programs. While pragmatic challenges to the implementation of EPAs remain, the best practices from EPA and other CBE assessment literature summarized in this review may assist individuals and programs in implementing EPAs. As EPAs become more widely used in general surgery resident training, further analysis of barriers and facilitators to successful and sustainable EPA implementation will be needed to continue to optimize and advance this new assessment framework.

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Author Affiliations: Department of Surgery, University of Alabama at Birmingham (Montgomery, Lindeman); American Board of Surgery, Philadelphia, Pennsylvania (Mellinger).

Corresponding Author: Brenessa Lindeman, MD, MEHP, Department of Surgery, University of Alabama at Birmingham, 1808 7th Ave S, Boshell Diabetes Building Ste 506, Birmingham, AL 35233 (blindeman@uabmc.edu).

Entrustable professional activities (EPAs) compose a competency-based assessment framework focusing on directly observable tasks that together make up the core aspects of a given specialty. Following their original description by ten Cate,[1] EPAs have been increasingly adopted by multiple medical specialties as well as undergraduate medical education. As part of the broader movement toward competency-based education (CBE) in general surgery training, the American Board of Surgery (ABS) developed and recently published a set of 18 core EPAs for general surgery as an assessment framework for trainees at all US residency programs.[2]

Along with a national pilot study of EPAs in general surgery led by the ABS, multiple institutions have studied the validity and implementation of EPAs as part of their assessment of surgical residents. While the incorporation of EPA assessments into the evaluation of surgical trainees is still relatively new, successes and challenges from these studies may provide important context as surgical residency programs across the United States integrate this assessment tool into their current processes.

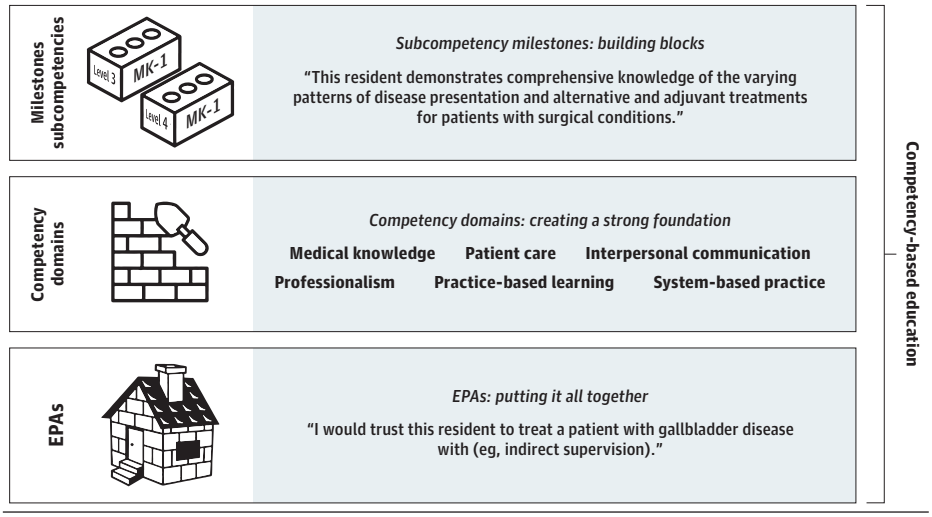
In this review, we explore the rationale for EPAs in general surgery; practical implications for trainees, faculty, and residency programs; and future integration of EPAs in surgical subspecialty residency and fellowship programs.

Rationale for EPAs in Surgery

Competency-Based Education Model

Current requirements for graduating general surgery residents include case volume– and time-based (ie, weeks of training) thresholds, despite the variable number of cases or training level at which a resident may actually achieve competence to perform a given operation or clinical task. Ongoing concerns around graduating resident preparedness have been expressed by both program directors and residents themselves, and residents have reported lower self-efficacy compared with faculty perceptions of their abilities.[3-8] These concerns have arisen within the context of seismic changes in training, including the evolution of the practice of general surgery, increasing regulatory requirements of attending physicians with concomitant decreasing resident autonomy, and changes in Accreditation Council for Graduate Medical Education (ACGME) duty-hour regulations.[9,10] Recognizing this disconnect in resident evalu-

Figure. Conceptual Framework of Levels of Competency-Based Education



EPAs indicates entrustable professional activities.

ation and preparedness, surgical education leaders have driven a transition over the last 2 decades toward CBE frameworks, which focus on more directly assessing resident competence instead of reliance on surrogate measures such as case volumes.[11,12] The CBE model for surgical education has drawn considerable interest from surgical educators; proponents highlight its emphasis on evaluating residents' abilities to perform relevant operative and nonoperative skills and de-emphasizing the checklist or "bean-counting" style of resident assessment that has been previously used.[13-16]

Surgical EPA Development and Pilot Study

Within the CBE educational model, EPAs represent an assessment framework that focuses on observable workplace-based microassessments of the level of supervision needed for a trainee to perform a given task (**Figure**). As first described by ten Cate in 2005,[1] EPAs should consist of the essential activities of a medical specialty and be directly observable. Incorporation of the EPA framework into general surgery has been led by the ABS in collaboration with the ACGME Surgery Review Committee, American College of Surgeons, and Association of Program Directors in Surgery. Together, these surgical education leaders designed a pilot study for EPAs in general surgery that was conducted from 2018 to 2020 at 28 surgical residency programs, including both community and academic centers.[17,18]

This study evaluated 5 newly developed EPAs among a national sample of general surgery residents. Pilot EPAs included evaluation and management of a patient with right-lower-quadrant pain, inguinal hernia, gallbladder disease, and blunt or penetrating trauma, as well as performing general surgical consultation. As recently reported by Brasel et al,[19] more than 6000 EPA microassessments were collected over the course of the pilot study, with 1763 summative entrustment ratings (determined by program clinical competency committees at 6-month study intervals based on accumulated microassessment data) completed for 497 residents. Increasing levels of entrustment were seen with increasing postgraduate-year level.

Importantly, the authors noted wide variability in the numbers of microassessments completed per resident by program, with a mean (SD) of 5.6 (13.4) microassessments but a median of only 1 microassessment per resident.[19] The pilot study allowed programs to implement EPAs and collect microassessment data using methods of their choosing, and this freedom, plus differences in program structures and cultures, likely contributed to the variability of EPA utilization during the pilot. Despite potential challenges for the widespread integration of the full suite of general surgery EPAs, overall results from this national EPA pilot study were encouraging and emphasized the importance of ongoing educational efforts by the ABS toward program faculty, trainees, and administrative staff. The full list of core EPAs for general surgery as published by the ABS is presented in the **Box**.

Additional Validity Evidence for EPAs in Surgery

A growing body of evidence from single- and multi-institution studies evaluating the use of EPAs for the evaluation of surgical residents has developed over the last half decade as the discussion around incorporating EPAs nationally has evolved. Multiple studies have presented data supporting the external validity of EPAs, including increasing entrustment levels with increasing resident postgraduate-year level and ability to achieve full entrustment (ie, unsupervised practice).[20-22] In 2 single-institution studies evaluating all 5 pilot EPAs and the gallbladder EPA, respectively, study authors also demonstrated strong positive correlation between EPA microassessment ratings and ACGME Milestone scores.[20,23] These correlations make intuitive sense given the deliberate mapping of Milestone competencies to EPAs by the ABS EPA development groups, while also providing evidence for their validity compared with current forms of resident assessment.[17]

In related work, Chen et al[24] described the development and testing of 6 procedure-specific assessments they termed *surgical EPAs* based on the ABS Operative Performance Assessment framework. After testing these surgical EPAs (different from the ABS-developed set) with resident-faculty pairs plus a third surgeon observer, they demonstrated strong positive correlation of resident entrustment ratings with the levels of guidance provided during the case, as well as their procedural performance and general skills. Procedure-specific autonomy and entrustment, global operative com-

Box. Core Entrustable Professional Activities (EPAs) of General Surgery

Three-Phase EPAs[a]

Right-lower-quadrant pain and appendicitis

Benign or malignant breast disease

Benign or malignant colon disease

Gallbladder disease

Inguinal hernia

Abdominal wall hernia

Acute abdomen

Benign anorectal disease

Small bowel obstruction

Thyroid and parathyroid disease

Need for renal replacement therapy

Soft tissue infection (including necrotizing soft tissue infection)

Cutaneous and subcutaneous neoplasms

Flexible gastrointestinal endoscopy

Perioperative care of the critically ill surgery patient (resuscitation, procedures, postresuscitation)

Blunt or penetrating trauma (trauma bay, procedures, transition of care)

Two-Phase EPA (Evaluation and Management)

Severe acute or necrotizing pancreatitis

Single-Phase EPA (Consultation)

Provide surgical consultation

[a] The 3 phases are preoperative, intraoperative, and postoperative except for the instances noted.

petencies, and resident learning efficacy were found to be most influential on performance.[24] Although this study focused only on intraoperative performance and its methods have not been repeated using the ABS general surgery EPAs, the overlap of operations included in the intraoperative care phase in some EPAs (eg, laparoscopic cholecystectomy, inguinal and ventral hernia repairs) suggest that similar underlying resident factors may be drivers of variation in resident entrustment in the set of ABS EPAs.

Practical Considerations for EPA Implementation

Trainees and Faculty

The integration of EPAs among all US general surgery residency programs presents both potential benefits and pragmatic challenges for trainees and faculty (**Table**). The more obvious barriers include the additional time and effort on top of already-taxed workloads of surgical teaching faculty, as well as additional burden on residents to discuss the need for EPA microassessments with faculty and send evaluation requests. Similar to issues discussed by Williams et al[25] at the time of changes to ACGME Milestones that planned to extend the length of evaluation forms, program directors will likely feel pressure to balance this new requirement of faculty with either decreased workload in other areas (eg, shortened end-of-rotation evaluations) and/or net benefit in providing useful and otherwise uncaptured information about resident competency. Additionally, EPA terminology and structure, including entrustment level ratings among the 18 core EPAs, present a new lexicon for front-line faculty and residents. Becoming fluent with this terminology will be facilitated by dedicated education to understand how the EPA assessment framework is different from end-of-rotation evaluations in both its philosophical approach and practical application.

Despite these upfront implementation barriers, EPAs have several potential advantages over current evaluation methods. First, instead of having faculty try to estimate how well a resident demonstrates isolated competencies in areas like Systems-Based Practice or Professionalism, EPAs take advantage of the inherent, ad hoc competency judgments that faculty are making every day while working with residents: that is, how much can I trust this resident to take care of this patient? Prior work evaluating faculty decision-making around resident entrustment and autonomy supports that while specific factors such as resident experience and clinical context can influence entrustment, this process happens empirically within the surgical training environment.[26-28] EPAs aim to serve as a natural extension of this process and quantify entrustment decision-making by faculty through linking it to directly observed behaviors. By having such a framework of expected behaviors at each level of entrustment as a reference, faculty may be more consistent in determining where residents fall in their entrustment level based on these observed behaviors.

From a resident standpoint, EPAs offer an opportunity for repeated, real-time feedback based on directly observed performance, which they may not otherwise receive with current evaluation methods. Instead of a single end-of-rotation evaluation, residents will steadily accumulate formative feedback across a spectrum of core general surgery domains during a given rotation and as they progress in their training. Additionally, with an increased focus on brief, real-time feedback using the EPA microassessment tool, faculty and residents alike may become more accustomed to incorporating a quick, constructive debrief into their postoperative or postclinic routines to help residents improve on specific operative or clinical decision-making skills.[29,30]

Ultimately, successful incorporation of the EPA assessment framework will require buy-in from both residents and faculty, who will share the additional tasks but also are motivated to receive and provide specific, constructive, timely feedback that EPAs will help to make part of their regular workflow. Based on a single-institution study focused on EPA implementation during the EPA pilot, empowering residents to generate EPA microassessment requests and optimizing the timing of these requests may help increase their completion rate.[31] These findings were consistent with operative performance rating (OPR) studies, which emphasized the importance of immediate rating completion, noting a significant decrease in feedback clarity and specificity at more than 3 days after observation.[29,30] Further insights from EPA implementation across different residency programs will be needed to help address any ongoing resident concerns about how EPAs are being used, as described by Gupta et al[32] from a survey of resident perceptions of pilot EPAs. Practical guidance for faculty about expected frequency of EPA microassessments completed per resident or per time period will likely be dictated by program-specific expectations, but assessment data collected over these initial years of EPA implementation may help clarify best practices for the future.

Table. Summary of Benefits, Facilitating Factors, and Barriers for EPA Implementation

Benefits	Facilitators	Barriers
For trainees and faculty		
Closer estimation to residents' true competence than Milestones	Easy-to-use smartphone-based app to request and complete EPA microassessments	Added time requesting and completing EPA microassessments
Real-time feedback, ability to trend microassessment results over a single rotation	Interactive dashboards available to trainees and faculty with EPA data	New terminology requiring dedicated training to educate faculty raters and trainees
Encourage postoperative or postclinic quick debrief	Standardized rating scale validated in prior work	
For the residency program		
Increase in real-time assessment of residents to track progress and identify struggling trainees	Interactive dashboards available to program directors to identify trends in resident performance	Administrative tasks of organizing EPA microassessment collection and reminding faculty and trainees
Mapping EPAs to Milestones allows for more streamlined Milestone ratings for program CCCs using EPA data	Opportunities to reduce end-of-rotation burden by using EPA data to fill performance assessment need	Identifying local champions among faculty, trainees, and department leadership

Abbreviations: EPA, entrustable professional activity; CCC, clinical competency committee.

Residency Programs

As with faculty and trainees, residency programs will also face their own unique barriers and facilitators to EPA implementation. Based on work from Stahl et al,[31] factors that supported completion of EPA microassessments during the pilot study included development of a user-friendly mobile application for assessment data collection and dedicated resident and faculty education around EPAs and levels of entrustment. Prior work from George et al[33] studying the duration of faculty training needed to achieve performance rating reliability for OPRs demonstrated that approximately 1 hour of training was sufficient, which may be a starting point for faculty training as an initial orientation to the EPA framework. Others have also highlighted the critical importance of local champions within the program, including departmental leadership as well as faculty and resident champions.[31,34] Some institutions have used microassessment completion targets as a strategy to increase EPA use, such as defining a certain number of microassessments that each resident should receive per rotation or defining which of the EPAs should be evaluated on specific services. On a more practical level, simple interventions such as regularly scheduled reminder emails to residents and faculty helped prompt requests for EPA microassessments and faculty completion.[31]

The primary data collection tool that will be used for implementation and tracking of general surgery EPA data is the ABS-EPA smartphone-based application hosted by the tool System for Improving and Measuring Procedural Learning (SIMPL), which the ABS is providing to all residency programs at no cost. The SIMPL-OR platform was originally designed for intraoperative performance assessment and has been previously studied in multi-institutional work that demonstrated high uptake by participating programs, including collection of more than 6000 3-question OPR assessments at 13 residency programs during a 6-month data collection period.[34] Initial analyses of this early study of the SIMPL platform described positive perceptions of the app's ease of use and value of narrative feedback for residents, as well as difficulties reported in overcoming inertia of changing daily workflows to include these assessments and creating a culture of participation that encourages instead of requires SIMPL use.[34,35]

While the expected number of EPA microassessments needed for a resident to achieve entrustment at the practice-ready level is unknown and will likely vary based on context and case complexity, prior work studying OPR assessments from Williams et al[36] demonstrated reliability and validity, noting specific trends in ratings such as increasing OPR scores with increasing resident postgraduate-year level. The authors noted that the use of 5 to 7 different faculty raters would reasonably control for rating idiosyncrasies between judges, with this number of raters likely feasible for most residency programs over the course of a 5-year training period.[36] In related work, they also noted that 2 to 3 OPRs per month provided a sufficient amount of data to support decision-making around resident progression.[37] Further results from study of the SIMPL-OR application suggested that 23 ratings are needed for faculty raters to achieve reproducible autonomy ratings for laparoscopic cholecystectomy, compared with 60 ratings for an undifferentiated mixture of general surgery operations.[38] This suggests that the learning curve for faculty will vary based on the complexity and volume of procedures they are rating. While anchoring to a specific number may neither be feasible nor necessary for the breadth of EPAs for general surgery and their separate phases of care, having a target for residents and faculty on a per-rotation or per–time period basis may help set a generalizable expectation for how to achieve a sufficient range of EPA microassessments in working toward entrustment.

While incorporating EPAs will involve new types of tasks for residency program leadership and administrative staff, the product of this labor should be a wealth of assessment data that will not only help benchmark residents' progress over time in ways that end-of-rotation evaluations are not able to provide, but hopefully also aid in identifying struggling residents earlier than could be accomplished previously. For program clinical competency committees, EPA data should provide a more consistent and repeated source of resident performance information and could also be used to help generate required ACGME Milestone ratings.[39] This is supported by both the intentional mapping of EPAs to 5 to 7 subcompetencies and associated milestones during their development, along with data from some confirmatory studies bolstering this correlation.[17,18,20] As EPAs are increasingly adopted within a program, program leadership may be able to reduce the end-of-rotation evaluation burden to the minimum information needed to supplement Milestone ratings, as the majority of residents' performance assessments would have been captured through EPA microassessments.[39]

Importantly, while EPAs will serve as an important data source to inform clinical competency committee ratings of Milestones, not

all subcompetencies are represented among the general surgery EPAs through EPA-Milestone mapping, as not all are directly observable in the context of a clinical encounter (ie, PROF-3, which assesses completion of administrative tasks). Additionally, some subcompetencies are represented sparingly in the EPA set (eg, PROF-4 assessing self-care and PBLI-2 assessing personalized learning plans are only mapped to a single EPA), emphasizing the continued need for alternative methods of evaluating these subcompetencies and their Milestones for required semiannual ratings.

Future Implications

Expansion of EPAs to Subspecialty Residency and Fellowship Programs

EPAs are also in different stages of development and implementation for multiple surgical specialties, both subspecialty integrated residency programs and independent fellowship programs following general surgery training. With similar challenges in resident and fellow preparedness being discussed in the vascular surgery education community,[6] a move toward a CBE model has also been ongoing, including study of OPR assessments using the SIMPL-OR app as well as EPA development through the ABS.[40] Other EPA development projects reported in the surgical education literature include multiple subspecialties within the Fellowship Council for their accredited gastrointestinal surgery fellowships, including EPAs for abdominal wall, bariatric, foregut, and hepatobiliary surgery as well as for flexible endoscopy.[41]

Created in collaboration with relevant society groups, these Fellowship Council EPAs can be customized based on the subtype of gastrointestinal surgery fellowship, with topics that move beyond core general surgery residency EPAs to more advanced activities that a fellowship-trained surgeon would be expected to manage (eg, "Evaluate and manage patients with parastomal hernias," "Evaluate and manage patients with esophageal motility disorders").[41] Other general surgery subspecialty fellowship EPAs under development or planned for future development include endocrine surgery (led by the American Association of Endocrine Surgeons), complex general surgical oncology (ABS), pediatric surgery (ABS), and trauma, burn, and surgical critical care (ABS) fellowships. Development and implementation of EPAs at the fellowship level presents an opportunity to better integrate trainee assessment across the continuum of surgical training, identifying areas of overlap between general and subspecialty practice while highlighting the skill sets unique to subspecialists. The opportunity to bring assessments from all of these specialties together in a unified platform would help support faculty across training programs to assess all learners with whom they work and track their progress over different stages of their training.

Other CBE Workplace-Based Assessments

While EPAs represent a competency-oriented clinical skills assessment framework and are therefore foundational to CBE initiatives in surgical training, there is more to CBE reform than EPAs. A full-orbed approach to CBE in medicine includes competency-directed curricular reform and the use of simulation to accelerate skill development outside clinical contexts. An example of the latter is the Fundamentals of Laparoscopic Surgery program.[42] Recent updates have incorporated an EPA-like model to ground the revisions in a manner oriented to competency end points. These are defined generically rather than by detailing discretely observed behaviors in a specific clinical context; collectively, they are not able to define a discipline, but rather describe a set of skills that individuals from multiple disciplines (general surgery, gynecology, urology, etc) might perform. Despite these differences, such approaches create alignment around competency-directed training for educators and trainees. This kind of thought coherence in educational planning to defined competence end points that harmonize with those captured in the EPA clinical skills assessment framework may serve educators and trainees well in the conceptual shift from time- and volume-founded training paradigms to competency-based ones.

Potential for Bias

Although EPAs are grounded in discrete, observable behaviors, which lend the view that they are based on more objective information, they remain subjective assessments completed by an individual rater and thus subject to bias. While studies of other workplace-based assessments in surgery have demonstrated concern for bias on the basis of gender,[43-45] early data from tools that use observable behaviors as part of their rating scale have not shown similar differences on the basis of gender. Single-institution data from the EPA pilot trial in 2 studies demonstrated no differences in EPA scores from faculty based on resident gender,[20,46] as did a multi-institution study of a different tool using third-party observer ratings of entrustment behaviors in the operating room.[47] These findings suggest that assessments linked to observable behaviors, such as EPAs, may not suffer the same types of bias as traditional subjective assessments. No data are currently available related to race or ethnicity given the small sample size in the single-center studies, leaving open an important question that could be answered with a nationally representative dataset.

Other Applications of Surgical EPAs

Beyond their contribution to resident performance evaluations and progression through levels of training, another potential application of general surgery EPA data includes exploring the relationship between graduating resident competency (as measured by accumulated EPA microassessments) and patient outcomes. A similar approach using non–fellowship-trained general surgery residency graduates' ACGME Milestones ratings and risk-adjusted complication rates did not demonstrate a statistically significant relationship between Milestone ratings and early-practice surgeons' outcomes.[48] As acknowledged by the authors and in an accompanying commentary, Milestone ratings are likely an imperfect measure of resident competency at best, given their vague descriptors and heavily retrospective nature.[23,48,49] EPAs may provide more specific data for understanding resident competency for a given procedure, and linking these data to large outcomes databases, ideally at a national level, may provide a more fruitful evaluation of the relationship between surgeon competence and patient outcomes, one of the ultimate goals of surgical education research.

Conclusions

EPAs represent a significant shift in the evaluation of general surgery residents as part of the progression toward CBE and prioritiza-

tion of assessing resident preparedness for independent practice. While pragmatic challenges to the implementation of EPAs remain, best practices from EPA and other CBE assessment literature summarized in this review may assist individuals and programs to implement EPAs. As EPAs become more widely used in general surgery residency programs, further analysis of barriers and facilitators to successful and sustainable EPA implementation will be needed to continue to optimize this new assessment framework.

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