

Regular Article

Entrustable professional activities (EPAs) in surgical pathology: implementation experience and longitudinal observations of resident development



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A B S T R A C T

Entrustable professional activities (EPAs) have been implemented in various medical specialties, and the Pathology National EPA Working Group has piloted the implementation of four pathology EPAs. We recently published the development of EPAs within our surgical pathology rotation. Following a six-month pilot, a survey demonstrated that faculty and residents found the forms helpful and easy to use and easy to understand, and EPAs have been fully incorporated into our surgical pathology rotation. Here, we discuss our experience, challenges, and results of resident EPA performance for intraoperative consultations (IOC) and sign-out (SO) after 21 months of implementation. Between June 2022 and March 2024, 24 residents were evaluated by 13 faculty members, resulting in 136 IOC and 298 SO EPA forms. Paper forms were predominantly used, with only five electronic forms submitted. EPA performance scores for SO increased from 2.4 ± 0.8 in Block 1 to 4.6 ± 0.2 in Block 14 ($p < 0.0001$), whereas performance scores for IOC increased from 2.7 ± 1.0 in Block 1 to 4.8 ± 0.2 in Block 14 ($p < 0.0001$). The progressive decrease in the standard deviation throughout residency denotes higher competence homogeneity as residency graduation approaches. Overall, our EPA evaluation method showed ease of use, provided valuable tracking tools, and long-term feasibility. EPAs are robust tools for tracking resident progression toward independent practice in surgical pathology, offering valuable insights for program and rotation directors to assess and track individual EPA skills, identify intervention points, and provide an opportunity for immediate, actionable feedback based on current performance.

Keywords: Surgical pathology, Medical education, Entrustable professional activities, Graduated responsibility, Competency-based medical education

Introduction

Competency-based medical education (CBME) is an outcome-based approach to designing, implementing, assessing, and evaluating medical education through an organized framework of competencies.¹ Over the past few decades, the main form of CBME in pathology training across the United States has been the Outcome-based Milestones, as required semiannually by the Accreditation Council for Graduate Medical Education (ACGME).²

Entrustable professional activities (EPAs) represent another form of CBME, in which assessment of trainee proficiency and readiness for independent practice can be performed daily in real-life scenarios. Ten Cate initially conceptualized EPAs in 2005 as units of professional practice

that can be entrusted to a trainee for unsupervised execution once they have attained adequate competence.³ In the United States, medical specialties that have piloted and/or incorporated EPAs in their training programs include general surgery and pediatrics, while other boards, such as orthopedic surgery and family medicine, have used alternative assessment tools.^{4–7} However, in pathology training and practice, the skills and expectations for independent practice differ significantly from other medical specialties, necessitating tools tailored to our field.

In 2017, the College of American Pathologists (CAP) Graduate Medical Education Committee suggested nineteen EPAs for training in Anatomic and Clinical Pathology, reflecting the ACGME milestones' goals.² In 2021, Bryant BH published their experience and feasibility of implementing EPAs in the setting of frozen section training involving two

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classes of pathology residents from one US-based institution.⁸ Subsequently, the National EPA Working Group conducted a pilot study involving six institutions. The pilot was conducted from July 2021 to July 2022, and four EPAs were validated: (1) Performance of a medical autopsy; (2) Frozen section preparation, review, and call-back; (3) Evaluation and reporting of adverse transfusion events; (4) Reporting of peripheral blood smear consultations.⁹ In our institution, the surgical pathology rotation functions on a 6-day cycle,¹⁰ and we recently piloted the implementation of four EPAs in surgical pathology.¹¹

Here, we discuss our experience, challenges, and results of resident EPA performance for intraoperative consultations (IOC) and Sign-out (SO) following 21 months of implementation. Although both individual and collective performance/learning curves have been plotted and discussed in the context of CBME assessment,¹² this article focuses exclusively on the collective learning curves, and all the X-axes are plotted to represent the group's performance in each surgical pathology rotation block.

Material and methods

Surgical pathology training setting: our surgical pathology rotation¹⁰ takes place entirely at one site and is divided into fourteen blocks with twenty workdays each, distributed as follows: PGY1: 6 blocks, PGY2-3: 6 blocks, and PGY4: 2 blocks. PGY1-PGY3 residents follow a six-day cycle (Days 1 and 2: grossing majors, Day 3: IOC and biopsies, Days 4 and 5: SO majors, and Day 6: IOC and biopsies), whereas PGY4 residents have "pre-fellow" rotations, when the resident is expected to take the same workload as fellows and spend each week in different subspecialties of their choice. At our institution, each PGY level typically has six AP/CP trainees. Our IOC service takes place in two different rooms: "Prentice" = breast and gynecological IOC; "Feinberg" = gastrointestinal, genitourinary, and general surgical pathology (Supplemental Material 1). SO is sub-specialized as follows: breast, gastrointestinal, genitourinary, gynecological, and general surgical pathology (Supplemental Material 2). Our EPA development was conceptualized considering a 4-year AP/CP training in the above environment.

EPA development: Prior to the pilot, the rotation director carefully examined our current surgical pathology practices and identified areas where there was a lack of graduated responsibility. A comprehensive literature review was conducted to assess the feasibility of implementing EPAs in surgical pathology training. The IOC form (Supplemental Material 1), which consisted of eight sub-competencies, was adapted with permission from Gomes et al.,¹³ and a SO form (Supplemental Material 2) with nine sub-competencies was created to meet the specific skills and expectations required for signing out surgical pathology specimens at our institution. Our "sub-competencies" breakdown corresponds to the "knowledge and skill statements" on the National EPA pilot.⁹

The clinical competency level scoring tools were developed parallel to Gomes et al., who assigned a Likert scale to detail the level of entrustment to the trainee, ranging from 1 ("I had to do it") to 5 ("I did not need to be there"). In addition, the clinical competence scale corresponds to "entrustment levels" on the National EPA pilot,⁹ and the scores are tied to Miller's pyramid of clinical competence¹⁴ and ACGME supervision levels.

"Train the trainer"–Faculty training and periodic recalibration: Thirteen of twenty-two (59 %) surgical pathology faculty members volunteered to receive training in EPA assessment. The surgical pathology rotation director conducted the training by presenting vignettes detailing an interaction between a hypothetical trainee and an attending. The simulated scenarios allowed the faculty to assign a score to each sub-competency, followed by a discussion with the rotation director on the most appropriate scores. During the six-month pilot and periodically thereafter, the rotation director provided "recalibration" to the faculty if the scores were unusual for the trainee's level of training.

Pilot evaluation and transition to full incorporation: Both electronic and paper forms were made available to the faculty. During the six-month pilot and full implementation, faculty completed IOC forms immediately

after the first case of the day, and SO forms after finishing all cases of the day, providing the residents with timely and actionable feedback on each sub-competency, aspects of the task performed well, as well as specific suggestions for improvement. While only a subset of volunteer faculty participated ($n = 13/22$, 59 %), the entire resident cohort ($n = 24$) was evaluated. A six-month survey involving faculty and residents was conducted to determine ease of use, value, and long-term feasibility (Fig. 1).¹¹

Data compilation and usage: IOC paper forms were available by the frozen benches, whereas SO paper forms were available at each attending's office. After the assessment, faculty and resident signed the form, and the resident delivered the paper to the Rotation Director's mailbox, who manually compiled the data in a Microsoft Excel® sheet weekly. The data was plotted and analyzed according to the resident's training block (Supplemental Material 3). Following the pilot and validation, individual data was shared with the Clinical Competency Committee (CCC) for semiannual evaluation purposes, and collective data was shared with the department leadership for long-term rotation improvement. To evaluate clinical competency,¹⁵ we defined a mean score of 4.0 ("I needed to be there just in case," indirect supervision/oversight) as the requirement for a sub-competency to be considered satisfactory for graduation or promotion to additional responsibilities with oversight only. For IOC, a mean score of 4.0 was designated as the requirement to achieve prior to taking AP call.

Results

The pilot survey was conducted from June 2022 to December 2022, and the post-pilot survey results are summarized in Fig. 1. The questions evaluated the ease of use, value, and long-term feasibility of the EPA tools. The answers were given on a Likert scale from 1 to 5 (1 = strongly disagree, 5 = strongly agree). Following the positive response from faculty and residents, the decision was made to keep the EPA assessment and incorporate it as a daily CBME tool for surgical pathology training.

Thirteen faculty evaluated twenty-four residents between June 2022 and March 2024, completing 136 IOC and 298 SO EPA forms (Supplemental Material 3). Even though both paper and electronic forms were provided, paper forms were predominantly used, with only five electronic forms submitted.

SO performance (Fig. 2): Overall SO performance score increased from 2.4 ± 0.8 in Block 1 to 4.6 ± 0.2 in Block 14 ($p < 0.0001$). The mean SO performance followed a linear trendline throughout training, with a concurrent decrease in the standard deviation.

The individual sub-competence analysis shows that trainees are a heterogeneous group with diverse levels of exposure and expertise to pathology, and they demonstrate trendlines in mastery of individual skills. During the first six blocks (120 workdays), all skills fail to achieve a mean score of 4.0 at the end of this period except for "obtaining relevant clinical and radiologic information" and "previewing the case and drafting an organized report." PGY1s face challenges in identifying relevant clinical and radiologic details. However, they gradually develop this competence over the next two years as they become familiar with navigating the patient's electronic medical record (EMR) information and filtering out pertinent information for each case. A similar trend is observed for the "case preview" sub-competence. Regardless of diagnostic accuracy, junior residents become familiar with the parameters of a well-drafted and organized pathology report, necessitating less editing on behalf of the faculty.

Aside from "interpersonal skills," most sub-competencies reach a plateau, observed from the end of PGY1 to the end of PGY2 (blocks 5 to 9), where most skills score on average below 4.0. Throughout the end of PGY3 and beyond (blocks 12–14), most residents scored steadily above 4.0 in all sub-competencies, resulting in mean EPA scores consistently above 4.0, deemed sufficient for oversight or indirectly supervised practice.

During the final stages of surgical pathology, pre-fellow rotations (blocks 13 and 14, PGY4) aim to enhance residents' skills in surgical

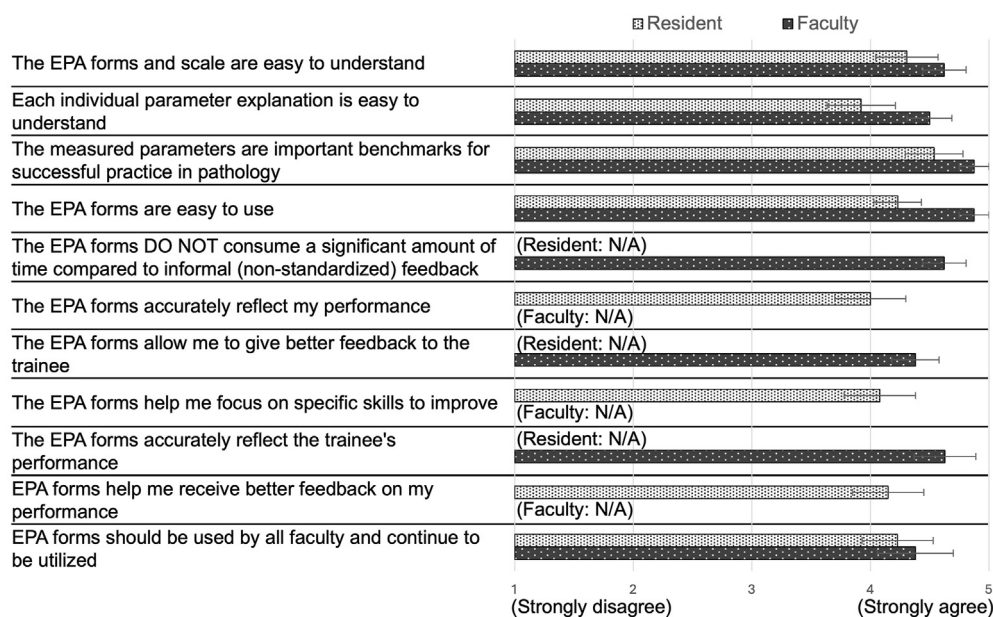


Fig. 1. The results of the survey evaluate ease of use and long-term feasibility following six months of pilot implementation. Residents and faculty were asked to answer eight questions on a scale from 1 (strongly disagree) to 5 (strongly agree). Resident's and faculty's mean (\pm SD) answers are plotted.

pathology, work efficiency, microscopic analysis, and differential diagnosis. At this stage of training, residents are responsible for a workload equivalent to that of a fellow. They must work independently on complex cases and reports (system-based practice sub-competency). On average, residents achieve scores above 4.0 during this period. Additionally, they are expected to train junior residents at this level.

IOC performance (Fig. 3): IOC EPA performance scores increased from 2.7 ± 1.0 in Block 1 to 4.8 ± 0.2 in Block 14 ($p < 0.0001$). The overall IOC performance followed a logarithmic trend line, with the highest increment observed during the PGY1: by the beginning of PGY2 (block 7), the mean score was 4.4 ± 0.7 . After that, the mean scores slowly and steadily increased, with a corresponding progressive decrease in the standard deviation.

Our analysis of each sub-competency curve reveals the importance of continuous education, supervision, and skills honing regardless of the PGY level. By the end of PGY1 (block 6), the trainees achieved a mean score of 4.0 in the pre-procedure plan, case preparation, surgery-pathology handover, technical performance, post-procedure plan, efficiency and flow, and communication sub-competencies. These results correspond to a satisfactory level of entrustment in all skills not linked to diagnostic interpretation. However, at that point, there remains variability and scores below 4.0 that highlight the need for continuous education and supervision. Diagnostic interpretation lags the other sub-competencies and follows the same trend as diagnostic accuracy in the SO form, not reaching the average score of 4.0 until block 12 at the end of the PGY3 year. These findings underscore the need for continuous IOC exposure, especially for gaining autonomy and increasing confidence and accuracy during frozen sections.

Discussion

Following the 2017 CAP Graduate Medical Education Committee's publication on EPAs for pathology² and the Pathology National EPA Pilot Study,^{9,16} the push towards using EPAs in pathology residency training has advanced significantly. Our EPA tools were conceptualized by adapting ten Cate's general EPA principles³ and national guidelines² and modified to our locoregional specificities, including surgical pathology rotation structure particulars.¹⁰ Following a successful pilot evaluation (Fig. 1), a decision was made to fully incorporate EPA evaluation as part of daily activities throughout the fourteen blocks of surgical pathology rotations.

One of the main barriers to EPA implementation encountered in the National EPA Pilot^{9,16} and in our cohort has been identifying faculty willing to be trained to apply the EPA tools daily ("EPA Champions"). "Training the trainer" and ensuring homogenous criteria for sub-competency assessment has been a significant challenge for EPA implementation in pathology. Our initial cohort of thirteen faculty represents 59 % of twenty-two surgical pathologists. Interestingly, our "EPA champions" are mostly junior and mid-career faculty (assistant and associate professors), including three academic leaders: the residency Program Director, the residency Associate Program Director, and the Surgical Pathology Rotation Director.

The National EPA Working Group has published their experience with faculty development during their pilot.¹⁶ Their "train the trainer" model occurred via virtual meeting sessions, including program directors, associate program directors, and rotation directors. In those sessions, videos defining EPAs, linking EPAs to ACGME milestones/competencies, describing components of trust, and listing the purpose of faculty development were reviewed. Faculty were asked to list essential steps for each EPA, recreating the specific EPAs in their own words. Vignettes written by EPA working group members were shared and discussed as faculty development sections, targeting and calibrating their entrustment levels evaluation. Our single-center experience involved a limited cohort of faculty within the same department, allowing for homogenization and recalibration to occur in a more "controlled" environment on a smaller scale; nevertheless, this involved the same principles as the ones described in the National EPA Pilot, in which the rotation director led sessions defining EPAs as another tool for CBME with vignettes for both IOC and SO scenarios. However, a major limitation of this study compared to the national pilot was the lack of rigorous validation of the vignette scenarios across entrustment levels 2 and 4, a point that will be addressed for additional faculty training.

Another concern has been whether one should consider the complexity of each case for EPA assessment. Some EPA working groups, including the National EPA Pilot, have addressed the case complexity in the forms.¹⁶ Similar to Gomes et al.,¹³ we standardized the IOC evaluation with the first IOC of the day, whereas the SO evaluation is performed after finishing all cases of the day. While we acknowledge that standardizing the first IOC of the day may lead to a selection bias of less complex cases, most of our IOC sub-competencies assess skills that are not necessarily related to the case complexity itself. Given the inability to predict the entire intraoperative consultation caseload for the day, our approach has been to fill the IOC EPA form on the first frozen of the day,

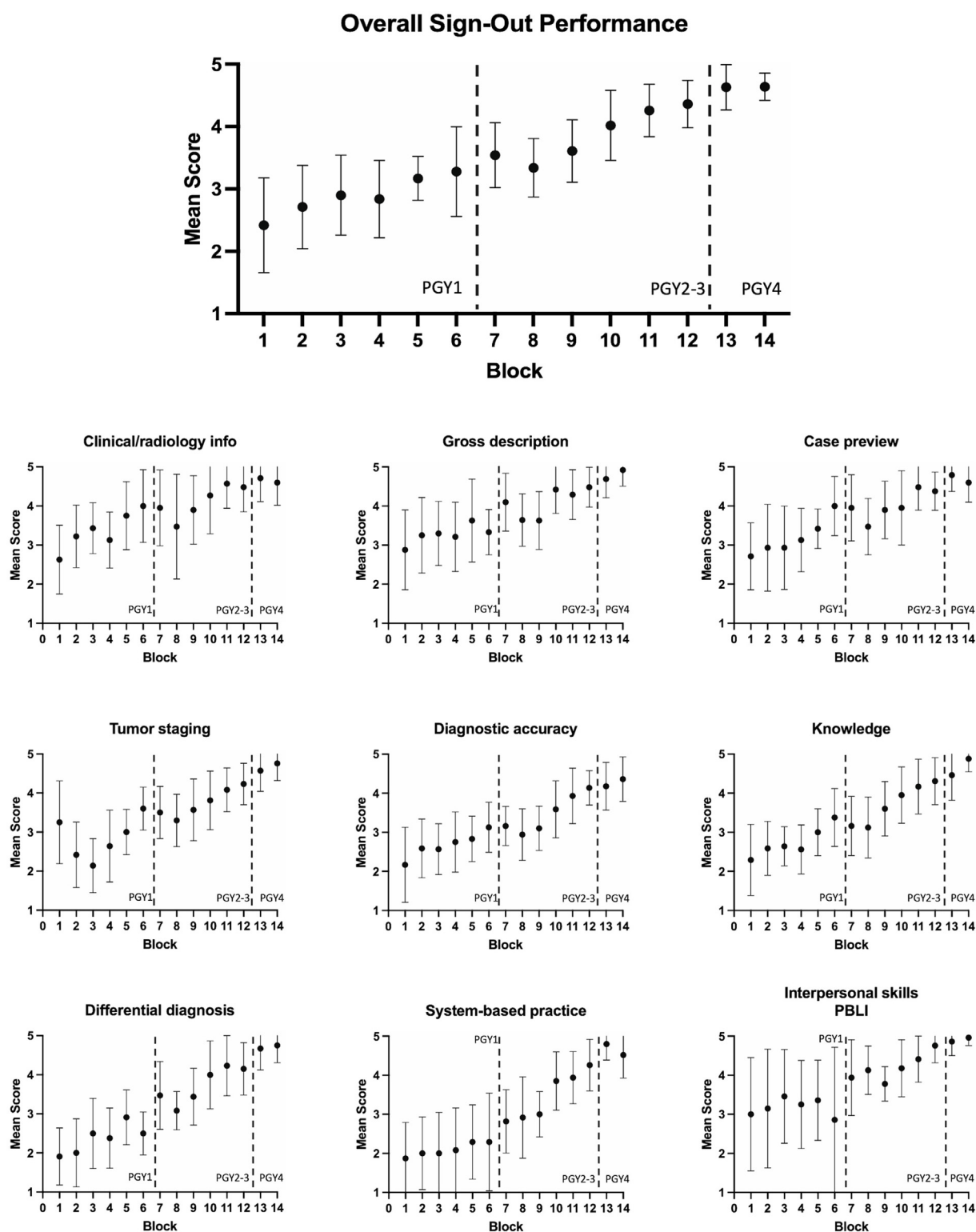


Fig. 2. EPA SO performance according to surgical pathology block. Overall performance (top) and individual sub-competence performances (bottom), stratified by PGY level (mean \pm SD). PBLI = practice-based learning and improvement.

which allows the trainee to receive immediate feedback that, if given later in the day if no additional IOCs were requested, may be subject to recall bias. Furthermore, the trainee is given the opportunity to apply the feedback and suggestions given to subsequent IOCs, permitting repeated application of constructive feedback into novel situations the same day.

The SO forms, on the other hand, were performed at the end of a full day of faculty-resident interaction signing out either majors or biopsies.

One might argue that this approach might "dilute" a deficient performance of a particularly challenging case. However, we believe that it allows the faculty to have an overview of residents' reasoning, knowledge, and flow for both "simple" and "challenging" cases and a day-long assessment of interpersonal and communication skills.

The trainee's perspective was assessed using the Canadian model, where some residents perceive EPA assessments as not truly "authentic"

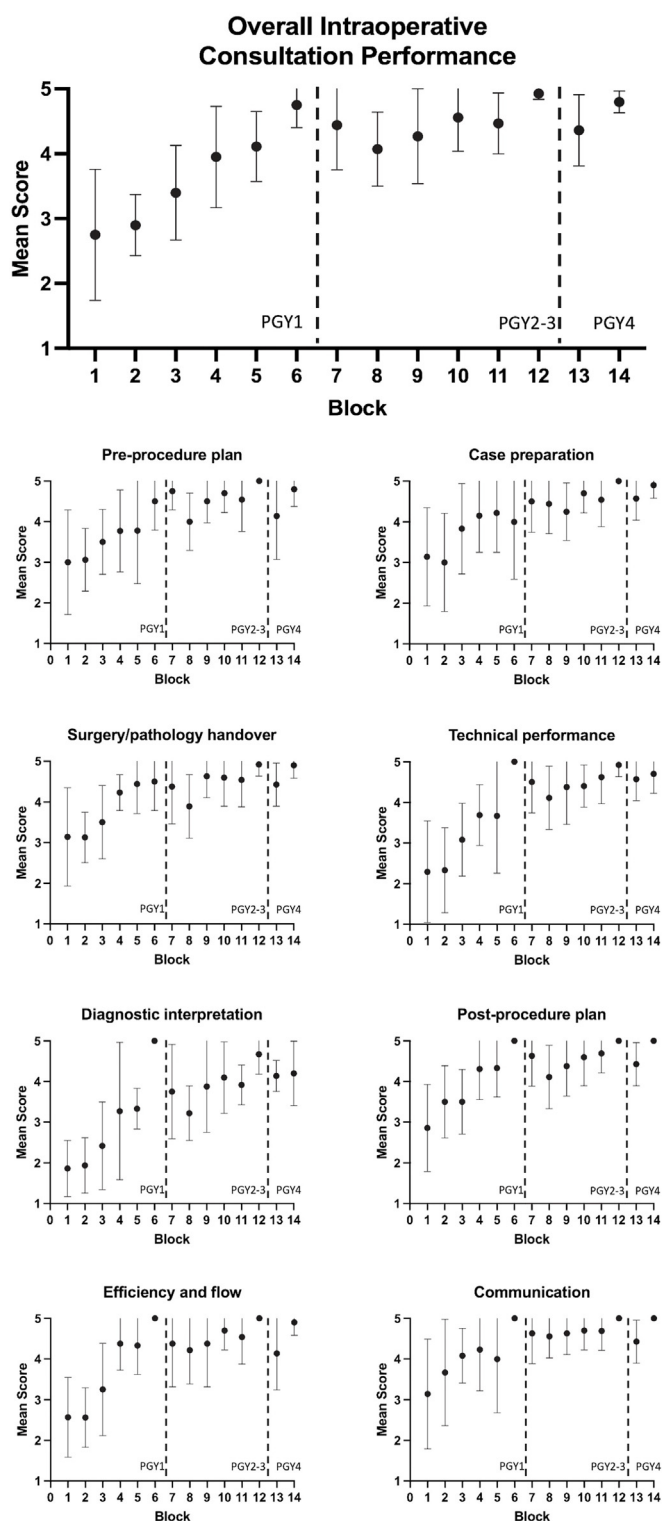


Fig. 3. EPA IOC performance according to surgical pathology block. Overall performance (top) and individual sub-competence performances (bottom), stratified by PGY level (mean \pm SD).

but as another "checklist" that needs to be filled out.¹⁷ Therefore, it is essential to note that EPA evaluations should be followed by immediate and actionable feedback on specific sub-competencies. On the other hand, the trainees should also be trained and educated on the importance of EPAs in CBME and how to best use the information and feedback provided on those forms rather than seeing them as "punitive" or just another "checklist." In our cohort, our focused and structured feedback on

each sub-competency was deemed valuable and easy for the trainees to understand (Fig. 1, questions 2 and 10).

From the leadership perspective, it is significant to note that our IOC and SO forms had Clinical Competence Levels (score 1 to 5) paired with ACGME supervision levels. Other groups, including the Pathology National EPA Working Group, have also employed that strategy. From the faculty and leadership perspective, this allows for a direct translation of each resident's daily performance with ACGME metrics and the corresponding Clinical Competency Committee's semiannual evaluations.

Collectively, both our IOC and SO data show that surgical pathology training can be divided into three critical milestones in surgical pathology education: first year (PGY1), mid-training plateau (PGY2-3), and senior homogeneity (PGY4). By the end of PGY1, IOC reaches a significant milestone. At this point, a mean score of around 4.0 indicates high confidence and reliability in performing IOC tasks with minimal direct supervision. This includes the additional responsibility of taking AP call, which typically begins at our institution during PGY2. For SO, the progression curve is more linear and steadily progressive. By the end of PGY3/beginning of PGY4, trainees reach satisfactory entrustment scores above 4.0, reflecting accurate and efficient case previewing and subsequent surgical pathology reports that require minimal to no adjustments (equivalent to a "pre-fellow" performance).

Future developments for EPAs in pathology in the United States include the creation of an accessible and easy-to-use electronic platform for completing EPAs within the daily workflow.⁹ Our cohort built a Qualtrics form (Qualtrics, Provo-UT, United States, 2023) as an alternative to paper forms. However, only five forms were filled out electronically, and the remainder (429) were filled out by paper. While the reasons why paper forms were preferred are not clear, a compilation by the rotation director was only feasible because the entire surgical pathology training takes place in the same building, and a relatively small cohort of faculty and residents were involved. That may not be the reality for other training institutions with multiple training settings, in which electronic forms may be a more feasible option. Moving forward, another attempt to implement an easy-to-use electronic platform with minimal added administrative burden. This may include the possibility of eliminating periodical evaluations (per block, month) and using only EPA forms with a summative performance by sub-competency, positive feedback, and suggestions for improvement at the end of each block.

Conclusions

EPA are valuable tools that assess everyday physician activities through multiple sub-competencies while providing the resident with daily, actionable feedback, allowing tracking of the resident's progression, and identifying specific sub-competencies that need improvement. Pathology training significantly differs from other medical specialties, and specific tools that reflect our everyday activities are needed. Here, we summarized our single-center experience with EPAs in surgical pathology, specifically for IOC and SO scenarios. Our EPA evaluations showed ease of use and demonstrated long-term feasibility with a strong preference for paper forms; however, steps to facilitate buy-in from residents and faculty, as well as making the forms more accessible, including digital solutions, are still necessary to improve compliance. Even though we had a limited number of "champion" faculty, our study presented strong quantitative data that can be used to provide a comprehensive, graphical evaluation of trainees. The data showcases both an overall multigenerational learning curve and individual trainees, allowing for a visual representation of progression through training and the acquisition of skills at different stages. EPA data provides detailed progress of individual trainee development, identifies areas for growth and rationale for academic intervention in case of educational stunting, and identifies those performing above average for permitting increased responsibility and independence — the goal of individualized assessment and training. To our knowledge, our program is the first pathology in the United States to fully report the implementation of EPAs for SO in surgical pathology.

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Declaration of competing interest

The authors have no competing interests.

Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.acpath.2024.100150>.

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