



Published in final edited form as:

Gastrointest Endosc. 2025 January ; 101(1): 12–24. doi:10.1016/j.gie.2024.03.025.

Development of American Society for Gastrointestinal Endoscopy standards for training in advanced endoscopy within dedicated advanced endoscopy fellowship programs

Sachin Wani, MD¹, Gregory A. Cote, MD, MS², Rajesh N. Keswani, MD, MS³, Rena H. Yadlapati, MD⁴, Matt Hall, PhD⁵, Jack O'Hara, BA¹, Tyler M. Berzin, MD⁶, Rebecca A. Burbridge, MD⁷, Prabhleen Chahal, MD⁸, Jonathan Cohen, MD⁹, Walter J. Coyle, MD¹⁰, Dayna Early, MD¹¹, Nalini M. Guda, MD¹², Sumant Inamdar, MD¹³, Lauren Khanna, MD¹⁴, Abhijit Kulkarni, MD¹⁵, Laura Rosenkranz, MD¹⁶, Neil Sharma, MD¹⁷, Eun Ji Shin, MD¹⁸, Uzma D. Siddiqui, MD¹⁹, Jasmine Sinha, MD³, Hendrikus Vanderveldt, MD²⁰, Peter V. Draganov, MD²¹

¹Division of Gastroenterology, University of Colorado Anschutz Medical Campus, Aurora, Colorado, USA

²Division of Gastroenterology, Oregon Health & Science University, Portland, Oregon, USA

³Division of Gastroenterology and Hepatology, Department of Medicine, Northwestern University Feinberg School of Medicine, Chicago, Illinois, USA

⁴UCSD Center for Esophageal Diseases, Division of Gastroenterology, University of California San Diego, La Jolla, California, USA

⁵Children's Hospital Association, Lenexa, Kansas, USA

⁶Beth Israel Deaconess Medical Center, Division of Gastroenterology, Harvard Medical School, Boston, Massachusetts, USA

⁷Division of Gastroenterology, Duke University Medical Center, Durham, North Carolina, USA

⁸Department of Gastroenterology and Hepatology, Digestive Disease Institute, Cleveland Clinic, Cleveland, Ohio, USA

Reprint requests: Sachin Wani, MD, Division of Gastroenterology and Hepatology, University of Colorado Anschutz Medical Center, Mail Stop F735, 1635 Aurora Ct, Rm 2.031, Aurora, CO 80045.

DISCLOSURE

The following authors disclosed financial relationships: G. A. Cote: Consultant for Interspace Diagnostics and Olympus Corporation; research support from Abbvie Pharmaceuticals. R. N. Keswani: Consultant for Medtronic and Boston Scientific. R. H. Yadlapati: Consultant for Medtronic, Phathom Pharmaceuticals, and StatLinkMD; research support from Ironwood Pharmaceuticals; advisory board with stock options in RJS Me-diagnostix. T. M. Berzin: Consultant for Medtronic, Boston Scientific, Vision AI, Magentiq Eye, and RSIP Vision. P. Chahal: Consultant for Boston Scientific and Medtronic. J. Cohen: Consultant for Olympus America and Micro-Tech; stock owner in GI Windows, Virtual Health Partners, and Rom-Tech; owner of MD Medical Navigators. W. J. Coyle: Speaker for Abbvie, Pharm and Regeneron, and Pharm D. Early: Scientific advisory board for Guardant Health. N. M. Guda: Consultant for Boston Scientific and Hemostasis Inc LLC; speaker for Lupin Pharmaceuticals, India. S. Inamdar: Consultant for Pentax Medical. E. J. Shin: Consultant for Boston Scientific. U. D. Siddiqui: Consultant and speaker for Olympus, Boston Scientific, ConMed, Medtronic, and Cook Medical; research support from Olympus and Boston Scientific. All other authors disclosed no financial relationships.

Presented at the ASGE Presidential Plenary Session and Topic Forum— Advancing Endoscopic Education for the Advanced Fellow, Digestive Disease Week 2023, May 6–9, 2023, Chicago, Illinois.

⁹Division of Gastroenterology and Hepatology, New York University Grossman School of Medicine, New York, New York, USA

¹⁰Division of Gastroenterology, Scripps Green Hospital, La Jolla, California, USA

¹¹Division of Gastroenterology, Washington University School of Medicine, St Louis, Missouri, USA

¹²Division of Gastroenterology and Hepatology, Aurora St Luke's Medical Center, Milwaukee, Wisconsin, USA

¹³Division of Gastroenterology, University of Arkansas for Medical Sciences, Little Rock, Arkansas, USA

¹⁴Department of Medicine, New York University Langone Health, New York, New York, USA

¹⁵Division of Gastroenterology and Hepatology, Allegheny Health Network, Pittsburgh, Pennsylvania, USA

¹⁶Division of Gastroenterology, Hepatology, and Nutrition, University of Texas Health, San Antonio, Texas, USA

¹⁷Division of Interventional Endoscopic Oncology and Surgical Endoscopy, Parkview Health, Fort Wayne, Indiana, USA

¹⁸Division of Gastroenterology and Hepatology, Johns Hopkins Medical Institutions, Baltimore, Maryland, USA

¹⁹Center for Endoscopic Research and Therapeutics (CERT), University of Chicago, Chicago, Illinois, USA

²⁰Department of Medicine, University of Texas Southwestern Medical Center, Dallas, Texas, USA

²¹Division of Gastroenterology, Hepatology and Nutrition, Department of Medicine, University of Florida, Gainesville, Florida, USA

Abstract

Background and Aims: Training in interventional endoscopy is offered by nonaccredited advanced endoscopy fellowship programs (AEFPs). The number of these programs has increased dramatically with a concurrent increase in the breadth and complexity of interventional endoscopy procedures. Accreditation is governed by competency-based education, yet what constitutes a “high-quality” nonaccredited AEFP has not been defined. Using an evidence-based consensus process, we aimed to establish standards for AEFPs.

Methods: The RAND UCLA appropriateness method, a well-described modified Delphi process to develop quality indicators, was used. A task force established by the American Society for Gastrointestinal Endoscopy drafted potential quality indicators (structure, process, and outcome) in 6 categories: activity preceding training; structure of AEFPs; training in ERCP, EUS, and EMR; and luminal stent placement. Three rounds of iterative feedback from 20 experts were conducted. Round 0 involved discussion of project details. In round 1, experts independently ranked proposed quality indicators on a 9-point interval scale ranging from highly inappropriate (1) to highly appropriate (9). Next, proposed quality indicators were discussed and reworded in a group

meeting followed by round 2, in which experts independently reranked proposed quality indicators and provided benchmarks (when applicable). The median score for each quality indicator was calculated. Mean absolute deviation from the median was calculated, and appropriateness of potential quality indicators was assessed using the BIOMED concerted action on appropriateness definition, *P* value method, and interpercentile range adjusted for symmetry definition. A quality indicator was deemed appropriate if the median score was >7 and met criteria for appropriateness using all 3 defined statistical methods.

Results: Of 89 proposed quality indicators, 37 statements met criteria as appropriate for a quality indicator (activity preceding training, 2; structure of AEFPs, 10; training in ERCP, 7; training in EUS, 8; training in EMR, 7; luminal stent placement, 3). Minimum thresholds were defined for 19 relevant quality indicators for number of trainers, procedures during fellowship, and procedures before assessment of competence. Among the final appropriate quality indicators were that all trainees should undergo qualitative and quantitative competence assessments using validated tools at least quarterly with documented feedback throughout the training period and that trainees should track outcomes and relevant quality metrics for specific procedures.

Conclusions: This consensus process using validated methodology established standards for an AEPF in an effort to ensure adequate training in the most commonly taught interventional endoscopic procedures (ERCP, EUS, EMR, and luminal stent placement) during fellowship. An important component of an AEPF is the use of competency-based assessments that are compliant with the Accreditation Council for Graduate Medical Education's Next Accreditation System, with the goal of ensuring that trainees achieve specific milestones in their progression to achieving cognitive and technical competency.

Advanced endoscopy fellowship programs (AEFPs) were established, in part, to address the burgeoning portfolio of therapeutic endoscopy and the inability of traditional 3-year Accreditation Council for Graduate Medical Education (ACGME)-accredited gastroenterology fellowship programs to provide comprehensive ERCP and EUS training.¹⁻² Since their inception, these AEFPs have evolved to offer training in a myriad of additional procedures, including EMR, endoluminal stent placement, deep enteroscopy, advanced closure techniques, bariatric endoscopy, interventional EUS, and submucosal endoscopy (including endoscopic submucosal dissection and peroral endoscopic myotomy).³

The number of AEFPs has increased dramatically over the past decade, and most AEFPs include training in ERCP and EUS, usually over a 1-year period. An increasing emphasis on additional procedures and newer techniques such as bariatric endoscopy and submucosal endoscopy has the potential to reduce advanced endoscopy trainee (AET) participation in ERCP and EUS during their year of training. Moreover, ERCP and EUS procedures done at many training programs at tertiary care centers are performed for complex indications, potentially reducing exposure to basic maneuvers in ERCP (eg, cannulation of the desired duct in native papilla cases and sphincterotomy) and EUS (eg, staging of cancers and EUS-guided tissue acquisition).^{2,4,5} These factors may increase the likelihood of suboptimal ERCP and EUS training. Given the recent transition from an apprenticeship and time-based model to competency-based medical education, an outcomes-based approach to the design, implementation, assessment, and evaluation of medical education programs using an organizing framework of competencies is needed.^{1,2,6} With the ACGME's Next

Accreditation System, the focus has shifted to ensuring that specific milestones are reached throughout training, that competence is achieved by all trainees, and that these assessments are documented by training programs.⁷

Although the breadth of training has increased along with an increase in AEFPs, there is no fixed mandatory curriculum and no set standards as to what constitutes a “high-quality” AAFP. Standards would ensure adequate training in interventional endoscopic procedures and would also facilitate the process of trainee assessment through competency-based milestones. Establishing standards would ensure AEFPs can appropriately tailor their training program and associated curriculum. These findings could have significant implications for the American Society for Gastrointestinal Endoscopy (ASGE) because the organization is responsible for recommending minimal standards for case volume exposure for AETs and for facilitating the matching program for AEFPs. An evidence-based approach was used to achieve the primary aim of this study, which was to establish the standards for AEFPs. In addition, we aimed to define the highest priorities for future research in interventional endoscopy training.

METHODS

This ASGE-led initiative used the RAND/University of California, Los Angeles appropriateness methodology (RAM) to develop standards for AEFPs.⁸ The measures developed have no legal implications but serve to recommend best practices for interventional endoscopy training programs. In RAM, the concept of appropriateness refers to the relative weight of the benefits and harms of an intervention. An appropriate indicator is one in which the expected benefit exceeds the expected negative consequences by a sufficiently wide margin, exclusive of costs. This is a modified Delphi method that, unlike the original Delphi, provides panelists with the opportunity to discuss their judgments between rating rounds, with a face-to-face meeting to discuss their answers, similar to the National Institutes of Health consensus conferences. This methodology is also applicable when randomized controlled trials are not available or cannot provide evidence at a level of detail sufficient to apply to the wide range of patients seen in everyday clinical practice. It is a well-described methodology that has been applied across a broad range of disease processes and procedures within gastroenterology.^{9–12} The overall project design, based on RAM, used to develop standards for training in interventional endoscopic procedures is highlighted in this section and in Figure 1.

Phase 1: recruitment of the expert panel

A multidisciplinary panel of experts (expertise in endoscopic training and quality, AAFP directors, ASGE Training and Advanced Endoscopy Training Committee representatives, current or recent interventional endoscopy trainees, RAM methodologist, and statistician) was recruited. The main selection criteria in the selection process included a history of peer-reviewed publications in the field of endoscopic training and quality, selected AAFP and gastroenterology program directors based on geographic diversity, practice setting and experience, and diversity of practice setting. Expert panelists participated in a 3-round

process. The panel composition, overall project, and document was approved by the ASGE Governing Board.

Phase II: meetings

Round 0 was conducted virtually on March 9, 2022. During this meeting, panelists were oriented to RAM and study objectives discussed. Five members of the study team (S.W., G.A.C., R.N.K., R.H.Y., and P.V.D.) were responsible for drafting the study protocol and initial standards statements under the following categories:

1. Interventional endoscopy fellowship training:
 - a. Activity preceding interventional endoscopy fellowship
 - b. Structure of AEFPs
2. Standards for training in the following procedures (structure, process, and outcome measures):
 - a. ERCP
 - b. EUS
 - c. EMR
 - d. Luminal stent placement

During round 1, panelists independently ranked statements by an electronic survey using REDCap (University of Colorado) with specific instructions to ranking and highlighted that the purpose of the proposed standards is to assist trainers and trainees with quality improvement and that all indicators are intended to be calculated and reported at the practice level and need not have a direct benefit to an individual patient. As per the RAM protocol, panel members were also instructed to ignore cost implications and feasibility issues inherent in implementing the measure. The panelists were advised to apply their ranking to the average trainee undergoing training at an average AEF. For a measure statement that the panel members deemed appropriate for inclusion, a suggested threshold was requested that may be used as a benchmark. Each indicator was ranked on a 9-point interval scale in which a score of 1 to 3 was deemed as inappropriate, 4 to 6 was of uncertain appropriateness, and 7 to 9 was deemed as appropriate. The panelists also had the opportunity to provide comments regarding each proposed standard statement and suggest modifications, which were reviewed by the core team members (S.W., G.A.C., R.N.K., R.H.Y., and P.V.D.).

The meeting for round 2 was conducted virtually on November 1, 2022. Before this meeting, individual summary results of round 1 rankings, with overall aggregated results, were provided to each panelist. In addition, details regarding RAM were provided (operational definitions of levels of appropriateness and methods to assess levels of disagreement). This meeting involved presentations by an expert RAM methodologists (R.H.Y.) and an expert statistician (M.H.), followed by a detailed discussion among the panelists with regards to each proposed statement. Panelists reviewed existing literature and areas of disagreement followed by rewording of statements when applicable. New statements could be proposed

during this meeting. After the meeting, the panelists then reranked each statement for its perceived levels of appropriateness.

Statistical analysis

At the end of rounds 1 and 2, responses for each question were summarized and provided to the participants using the median. At the end of round 1, panelists were provided, for each question, a histogram indicating the distribution of the responses with their individual rating indicated in addition to the median response, measures of spread of the responses, and 3 measures of appropriateness. The measures of spread included the count of responses in each 3-point region (1-3, 4-6, and 7-9) and the mean absolute deviation from the median. Appropriateness of a statement (typically classified as appropriate, uncertain, or inappropriate) was based on the median rating and whether or not panelists agreed or not, as measured by the amount of dispersion of the ratings.

Because a consensus is unavailable on the best approach to measuring dispersion and different methods can result in different conclusions, the participants were provided 3 different versions: BIOMED classic, *P* value, and interpercentile range adjusted for symmetry (IPRAS). The BIOMED classic definition is an extension of the RAND classic definition beyond 9 panel members and defines for different panel sizes the maximum number of responses that are allowed to fall outside the 3-point region that contains the median to conclude agreement. The *P* value method's definition of agreement is the result of a binomial hypothesis test that 80% of the ratings are within the 3-point region containing the median. Finally, the IPRAS is based on the nonparametric measure of spread, the interpercentile range (the interpercentile range is the difference between the 70th percentile and the 30th percentile). After adjusting for the lack of symmetry in the responses, the resulting IPRAS that is less than the interpercentile range indicates disagreement.

A measure was considered appropriate if the metric met the definition of appropriateness using all defined statistical methods. All statistical analyses were performed using SAS V. 9.4 (SAS Institute, Cary, NC, USA).

RESULTS

Activity preceding training

1. Trainees should be competent in upper endoscopy and colonoscopy.
2. Trainees should have completed training in an ACGME- (or equivalent) accredited fellowship in gastroenterology and hepatology.

There is widespread acknowledgement that interventional endoscopy procedures such as ERCP, EUS, and others are operator-dependent and technically challenging procedures that require unique technical, cognitive, and integrative skills.^{1,2} The panelists agreed that competency in upper endoscopy and colonoscopy is a prerequisite before training in interventional endoscopy procedures (Table 1).

Structure of training programs

1. Trainees should have a defined percentage of their effort and time devoted to supervised interventional endoscopy clinical activities, which is defined as no less than 80%.
2. Trainees are encouraged to develop and execute a mentored original research study.
3. Trainees should be encouraged to attend a defined minimum number of institutional conferences (when available) on topics relevant to interventional endoscopy.
4. An AEFPP should have a minimum number of trainers performing training in interventional endoscopy (Agreed threshold, 2).
5. An AEFPP must offer training in both EUS and ERCP.
6. An AEFPP must offer training in EMR.
7. Trainees should undergo competency assessments using validated tools (when available) at regular intervals and with documented feedback.
8. AEFPP directors should report the number of trainers and trainees on the AEFPP match website.
9. Trainees should track outcomes related to participated procedures.
10. Trainees should have a basic understanding of radiation safety and interpretation of fluoroscopy.

These measures provide overall guidance regarding centers participating in interventional endoscopy training. AEFPPs should provide training in ERCP, EUS, EMR, and luminal stent placement, usually considered the core disciplines in interventional endoscopy. Given the variable rates at which trainees achieve competence in these core disciplines, a minimum training period of 12 months is recommended. This will likely ensure that trainees have hands-on training (training with AETs handling the endoscope beyond just procedure observation) and exposure to the minimum number of procedures required to assess for and demonstrate competence. AEFPPs are encouraged to follow the ASGE core curriculum established for various interventional endoscopy procedures.^{13–17}

In collaboration with the interventional endoscopy fellowship directors, the ASGE Training Committee has developed metrics to characterize training programs participating in the match program administered by the ASGE, including details regarding procedures that trainees will receive training for and the expected volume and number of trainers. These metrics are important for prospective applicants and also provide a reference for the types of AEFPPs participating in the match. The panelists agreed that AEFPP directors should report these metrics on the match website (www.asgematch.com). It is suggested that AEFPPs providing training in interventional endoscopy provide a sufficient volume of procedures and number of trainers to meet the thresholds suggested overall and for specific procedures listed below.

Although a minimum number of 2 trainers is recommended for training in interventional endoscopy, this article does not provide guidance on the experience level required to be a part of an AEFP and is not meant to address training in the setting of a sudden decrease in the number of trainers. The ASGE has endorsed “train the trainers” courses that instruct trainers in the fundamentals of adult learning theory to improve their skills as trainers, such as providing a framework for effective feedback, setting goals for each session, and using consistent training terms during training.^{18–20}

The panelists agreed on the overall significance of the time spent in participating in interventional endoscopy procedures during training, which should be no less than 80%. AETs are encouraged to engage with multiple learning resources and opportunities within and outside the training institution. Within the institution, AETs should ideally be involved in multidisciplinary meetings (when available) and other meetings that could enhance training in interventional endoscopy. It is suggested that AETs engage in an original research or quality improvement project, and AEFPs should provide the requisite support to execute such studies. Consistent with the recommendations provided by the European Society of Gastrointestinal Endoscopy (ESGE), the panelists agreed that AETs should maintain a contemporaneous logbook of all cases, degree of trainer support, and outcomes related to the procedure with a focus on completion of all procedure endpoints and adverse events.¹⁸

Competence assessment for interventional endoscopy procedures using validated tools. A growing movement in medical education involves a shift from an apprenticeship model to competency-based medical education with increasing emphasis on standardized competence assessments and demonstration of readiness for independent practice.¹

It is well established that trainees learn and acquire endoscopic skills at variable rates and that a minimum volume of procedures cannot ensure competence.^{1,2,5,21–23} Society guidelines specify competence thresholds as opposed to absolute procedure volume requirements as a means to determine competence in several interventional endoscopy procedures, with thresholds varying between guidelines.^{1,24} A competence threshold is a minimum number of supervised procedures that a trainee needs to perform before competence can be assessed; an assessment of competence then requires direct observation and the use of objective criteria and procedural milestones. These competence thresholds remain valuable to guide training programs as to the minimum case volume they need to offer trainees and when they can realistically begin to make summative skill assessment of trainees based on objective criteria.²⁵ Providing these competence thresholds, for the included interventional endoscopy procedures, is an important contribution of this document.

In addition, the definition of competence itself has evolved. Traditionally, ERCP competence was defined as the ability to cannulate the duct of choice (selective cannulation of >90%).¹⁸ However, this important first step does not ensure procedural success and thus is an incomplete measure of competence. In contrast, successful completion of the entire procedure and achievement of the set goals are more comprehensive measures of competence. Evaluation requires an assessment of performance on individual skills

(eg, successful cannulation, stone extraction, stent placement, adequate sample during EUS-guided tissue acquisition, etc) as well as the global assessment of competence.¹ Conceptually, competence in advanced endoscopy should be considered in 3 broad competence domains: technical (psychomotor), cognitive (knowledge and recognition), and integrative (expertise and behavior).²⁶

Several instruments specific to interventional endoscopy procedures (ERCP, EUS, and EMR) have been developed and validated that incorporate the core competencies of the ACGME and include key technical, cognitive, and integrative aspects of each procedure. The panelists recommend the use of validated assessment tools for competence in interventional endoscopy procedures. The ASGE recommends that AEFs use the EUS and ERCP Skills Assessment Tool (TEESAT), a competence assessment tool with strong validity evidence for performance evaluation of these 2 procedures.^{1,2,5,22,25} The ESGE also endorses the use of formal assessment tools such as the Direct Observation of Procedural Skills and TEESAT to track trainee competence in EUS and ERCP and to support trainee feedback.¹⁸

A systematic review that evaluated all ERCP observational assessment tools showed that TEESAT and ERCP Direct Observation of Procedural Skills have strong validity evidence compared with other assessments.²⁷ These validated tools should be used in a continuous fashion throughout fellowship training. Assessments should be recorded immediately after completion of the procedure or as soon as reasonably possible and should include evaluation of at least 20% of the AET's procedures, distributed throughout the training period.

ERCP training

1. All ERCP trainees should also have received or be undergoing EUS training.
2. A trainee should have a minimum number of ERCP procedures that include meaningful hands-on exposure during training (Agreed threshold, 200).
3. Before an assessment of competence, a trainee should have participated in a minimum number of ERCPs with hands-on exposure (Agreed threshold, 150).
4. Before an assessment of competence, a trainee should have participated in a minimum number of ERCPs with hands-on exposure in patients with a native papilla (Agreed threshold, 50).
5. Before an assessment of competence, a trainee should have performed a minimum number of sphincterotomies (Agreed threshold, 25).
6. All ERCP trainees should track technical quality metrics such as the ability to cannulate independently during their training.

ERCP is the cornerstone of training in interventional endoscopy and was the procedure that prompted the development of post-fellowship training programs in the first place. Given the common overlapping indications for pancreaticobiliary EUS, the committee agreed that training programs should offer technical and cognitive education in both procedures (statement 1). This would promote a workforce capable of addressing the most common indications for pancreaticobiliary EUS and ERCP: assessment for suspected choledocholithiasis (EUS), treatment of choledocholithiasis (ERCP), and assessment and

treatment of indeterminate and malignant bile duct strictures (EUS and ERCP). A training paradigm that includes EUS and ERCP should encourage a practice of offering ERCP for therapeutic indications (Table 2).

Although it is possible that an exceptional learner could become competent in ERCP with fewer procedures, the committee agreed that all training programs should have a robust procedural volume. This ensures that most trainees will have sufficient hands-on exposure to achieve competence during the training period. Considering that a trainee is unlikely to participate in every ERCP offered over the course of his or her training period, a program should structure their curriculum to ensure that each trainee has exposure to a minimum number of ERCP procedures (200), most of which include a hands-on component (150), native papilla (50, to afford a minimum number of procedures to practice cannulation techniques), and hands-on practice with endoscopic sphincterotomy (25). These numbers are derived from limited research studies yet are consistent with consensus documents across the world.^{28–30} More recent research evaluating the role of competency-based assessment tools reveals that learners acquire skills at different rates and maybe influenced by their case mix,³¹ hands-on time, use of simulators,³² and their trainers.²⁷ Therefore, a program that barely meets the minimum standards outlined in this article should be prepared to have learners that require volumes that greatly exceed those outlined.³³

The panelists agreed that AETs should track their technical outcomes throughout training. Although this does not ensure competence, it promotes good practice as the learner prepares for independent practice, provides a method by which the learner can confirm his or her training meets minimum volume standards, and should be used by credentialing committees when practitioners apply for clinical privileges.

EUS training

1. All EUS trainees should have received or be undergoing
2. ERCP training.
3. A trainee should have a minimum number of EUS procedures with hands-on exposure (Agreed threshold, 200).
4. Before an assessment of competence, a trainee should have participated in a minimum number of EUS procedures with hands-on exposure (Agreed threshold, 150).
5. Before an assessment of competence, a trainee should have participated in a minimum number of EUS procedures with hands-on exposure in patients for pancreaticobiliary indications (Agreed threshold, 50).
6. Before an assessment of competence, a trainee should have participated in a minimum number of EUS procedures with ENA and/or fine-needle biopsy (FNB) sampling (Agreed threshold, 25).
7. A trainee should track EUS-specific quality metrics, including EUS-guided ENA and/or FNB sampling adequacy rate.

8. A trainee should track EUS-specific quality metrics, including EUS-guided FNA and/or FNB sampling diagnostic yield of malignancy.

Although it is clear that a specific volume of procedures cannot ensure EUS competence, the experts agreed that a minimum number of EUS examinations should be *offered* during an AEFP to maximize the likelihood of achieving competency. The minimum threshold of EUS procedures offered during an AEFP of 200 is based on prior work showing that the *average* AET achieves competency in EUS-guided FNA at approximately 225 EUS procedures when using a validated tool (TEESAT) and achieves technical competency in EUS after 125 procedures.^{22,25} The average AET achieved competency in EUS using TEESAT “global assessment” of competency after 165 procedures. In contrast, an alternative tool found that the average Japanese EUS trainee required significantly more EUS procedures to achieve EUS competency, and this was attributed to this tool being significantly more comprehensive in what defines “competency.”³⁴ The authors of that study noted that when considering the same elements as TEESAT, the average Japanese EUS trainee achieved competency after 229 cases. Because some AETs achieve EUS competency at lower volumes, the experts believed that beginning an assessment for competency after 150 EUS examinations was reasonable (Table 3).

Other work found that the average AET achieved competency in EUS-guided FNA and/or FNB sampling after he or she achieved competency in other technical and cognitive aspects of EUS; this is in part because EUS-guided FNA and/or FNB sampling may not be performed in most procedures. The experts believed that EUS-guided tissue acquisition competency could be assessed after 25 EUS procedures that included FNA or FNB sampling; in a prior systematic review, the average trainee reached competency by 30 to 40 procedures.³⁵ Notably, this threshold is significantly lower than the number of EUS-guided FNA procedures required to achieve competency for the average AET in another study (110 EUS-guided FNA procedures).²⁵ Few data have described when trainees might be expected to achieve competency specifically in pancreaticobiliary EUS. However, we note that most EUS procedures are for a pancreaticobiliary indication.

In previous studies on EUS quality metrics, select priority indicators were identified for measurement to ensure high-quality EUS.^{36,37} Two priority indicators were the diagnostic rate and sensitivity for malignancy in patients undergoing EUS-guided FNA of pancreatic masses (>70%). Another measure was the overall proportion of EUS-guided FNA and/or FNB sampling procedures where an adequate sample was obtained (>85%; ie, adequate amount of tissue seen by cytologist or pathologist to make a diagnosis). Experts are able to achieve a diagnosis of malignancy at a significantly higher rate than trainees.³⁸ Given that one of the critical components of diagnostic EUS is acquiring sufficient tissue to make a diagnosis, the panel believed that AETs should monitor their performance during their AEFP in terms of both how often they are obtaining sufficient amounts of tissue to make a diagnosis and how often a diagnosis is made. In prior work, this research group has shown that measuring the quality of EUS-guided tissue acquisition in both training and independent practice is feasible.¹

In contrast to thresholds adopted for diagnostic EUS, the experts were not able to provide training standards for therapeutic endosonography. Specifically, consensus was insufficient on whether therapeutic EUS procedures such as pancreatic fluid collection drainage, gallbladder drainage, and biliary drainage must be offered during an AEFEP and, if performed, how many procedures are needed to achieve competency. Research around measuring and achieving competency in therapeutic EUS is needed.

EMR training

1. For EMR trainees, AEFEPs should have a minimum number of trainers who participate in hands-on training (Agreed threshold, 2).
2. Trainees learning EMR should be trained in upper and colon EMR.
3. Trainees learning upper EMR should also be trained in ablative therapies.
4. Trainees must also demonstrate competency in electrosurgical principles.
5. Trainees should have a minimum of EMR procedures (upper GJ and colon) with hands-on exposure during training (Agreed threshold, 20).
6. Before an assessment of competence, a trainee should have participated in a minimum number of upper and lower EMR procedures with hands-on exposure (Agreed threshold, 10).
7. Trainees should track quality metrics from EMR procedures that include independent and complete resection rates.

Most recommendations for training in EMR are “common sense” opinion pieces based on expert opinion.^{39,40} Studies looking specifically at EMR training within the confines of AEFEPs are limited. In a small study of 6 AETs from 6 different institutions, the en-bloc resection rate of polyps <20 mm was only 57.7%. Trainee performance of ≥ 30 EMRs (odds ratio, 6.80; 95% confidence interval, 2.80-16.50; $P = .00001$) and lesion size of ≤ 17 mm (odds ratio, 4.56; 95% confidence interval, 1.23-16.88; $P = .02$) were factors associated with an en-bloc EMR rate of $\geq 80\%$.⁴¹ In another related study from the same study group, all 6 AETs reported feeling comfortable performing colorectal EMR independently at the end of their training, yet only 2 of them achieved competence in their overall EMR performance, based on a formal assessment with a dedicated evaluation tool.⁴² The minimum threshold to achieve competence in these 2 trainees was 25 colon EMRs. Based on these findings, a need for significant improvement in EMR training is apparent within the confines of AEFEPs. The most recently published ASGE and ESGE core curricula for training in EMR provide a very useful framework and outline the core technical, nontechnical, and cognitive skills necessary for training in EMR.^{43,44} Although tools for evaluation of EMR competency have been described, use of these tools in AEFEPs is limited and largely confined to the research arena.^{42,45} The EMR standardized assessment tool was developed by expert endoscopists in colorectal EMR and designed to evaluate key concepts and core skills necessary for high-quality EMR as per the ASGE practice guidelines.⁴²

The panelists agreed that AETs should be trained in upper EMR and ablative techniques (Table 4). AETs maybe offered the opportunity to work with trainers outside of the AEFEP

within their institutions in rare instances where trainers within the AEFP do not have the expertise in EMR and/or ablative techniques. Fewer data describe the learning curves in upper EMR and use of ablative techniques specifically in the management of patients with Barrett's esophagus-related neoplasia. This is a knowledge gap that needs to be addressed in future studies. The British Society of Gastroenterology and ESGE suggest that a minimum of 30 supervised cases of EMR and 30 cases of endoscopic ablation should be performed to acquire competence in technical skills, management pathways, and adverse events.^{46,47} The panelists agreed that AETs must also demonstrate competency in electrosurgical principles. Finally, the panelists agreed that AETs should track their performance in EMR with a focus on independent and complete resection and adverse event rates.

Luminal stent placement training

1. For luminal stent placement, AEFPs should have a minimum number of 2 trainers who participate in hands-on training.
2. Trainees learning luminal stent placement should be trained in esophageal, gastroduodenal, and colonic stents.
3. Trainees should have a minimum number of luminal stent placement procedures with hands-on exposure during training.
4. Before an assessment of competence, a trainee should have participated in a minimum number of 10 luminal stent placement procedures with hands-on exposure.
5. Before assessment of competence, a trainee should demonstrate an understanding for the indication and placement of additional stents and retrieving/repositioning migrated stents.

Several skills for luminal stent placement are directly related to corresponding ERCP skills and appropriate use and knowledge in the use of fluoroscopy. Data describing learning curves and definitions of competency in luminal stent placement are limited with no validated competency assessment tool ready for clinical application. Given that luminal stent placement is an integral component of AEFPs, the panelists agreed that providing guidance on training in this procedure was necessary using consensus opinions (Table 4).

DISCUSSION

Future directions

This study did not provide any guidance on the role of simulators in interventional endoscopy training. The role of simulators in this space needs to be clarified in future prospective trials that provide validity evidence for proposed tools and if simulators can "bend" learning curves and lead to a reduction in the number of procedures required to achieve competence, reduce the number of adverse events, and may also be used as objective measure of competence.^{1,48} Standards for training in other interventional endoscopy procedures such as third-space endoscopy, bariatric endoscopy, and interventional EUS procedures were not addressed in this study, largely driven by the limited data addressing learning curves, competence thresholds, and validated competence assessment

tools. Future studies need to establish training pathways, learning curves, and competence thresholds in these procedures.

The panelists acknowledged that competence in interventional endoscopy extends beyond the training period in AEFPs.² Although no guidance on the mentored support that AETs require after training was addressed in this study, AETs should continue to be supported by mentors and senior colleagues within and outside of their institution. The panelists also recognized that several statements were drawn from very low to low quality of evidence and, as such, were derived from expert opinion of the panel using the RAM. Future endeavors need to assess the number of AEFPs that meet the criteria and thresholds described in this article and establish a standardized curriculum for training in advanced endoscopic procedures.

Finally, establishing a centralized national registry that provides learning curves to program directors and AETs on demand or on a periodic basis related to interventional endoscopy procedures is clearly needed. This would allow for widespread implementation of a standardized approach to assessing competence using validated assessment tools and could allow us to ensure that AETs attain the skills necessary for independent practice.

Conclusions

The results of this ASGE-led initiative, which uses an evidence-based approach, provides standards for AEFPs and identified the highest priorities for future research in interventional endoscopy training. These measures and associated thresholds have significant implications for all stakeholders including AEFPs, AETs, and gastroenterology societies in defining what minimum procedure volumes AEFPs must provide to ensure that most AETs have the opportunity to achieve competence in the core interventional endoscopy procedures. In addition, this facilitates compliance with the ACGME's Next Accreditation System requirements for trainee assessment through competency-based milestones, tailored training, and document progression to cognitive and technical competence.

Abbreviations:

ACGME	Accreditation Council for Graduate Medical Education
AEEP	advanced endoscopy fellowship program
AET	advanced endoscopy trainee
ASGE	American Society for Gastrointestinal Endoscopy
ESGE	European Society of Gastrointestinal Endoscopy
FNB	fine-needle biopsy
IPRAS	interpercentile range adjusted for symmetry
RAM	RAND/University of California, Los Angeles appropriateness methodology

TEESAT the EUS and ERCP Skills Assessment Tool

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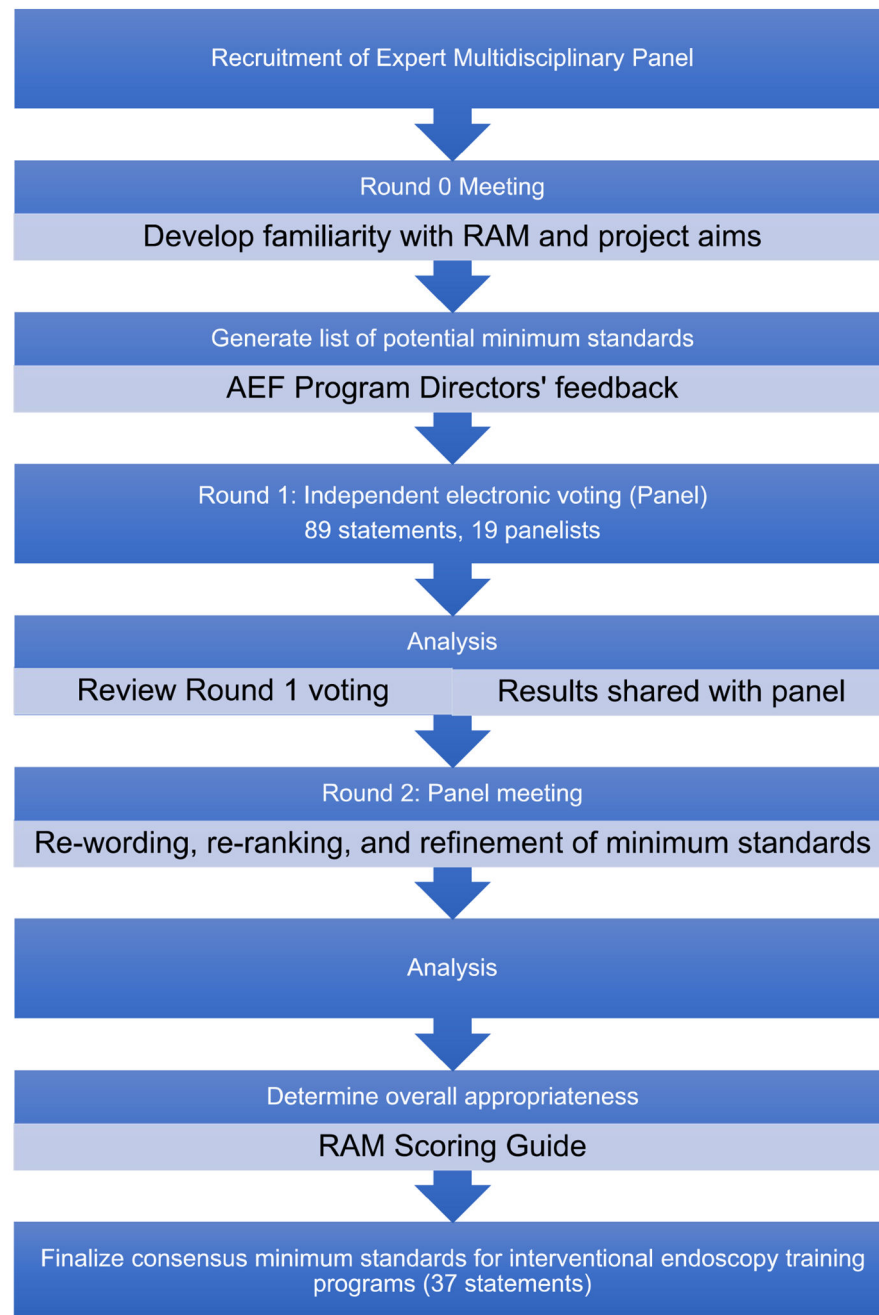


Figure 1.

Study design used for the development of consensus standards for interventional endoscopy training programs. *RAM*, RAND/University of California, Los Angeles appropriateness methodology; *AEF*, advanced endoscopy fellowship.

TABLE 1.
Appropriate measures for standards for interventional AEFPs: activity preceding training and structure of training programs

Statement	Appropriateness according to specific method			Median	Mean absolute deviation from the median	Count in 1-3 range	Count in 4-6 range	Count in 7-9 range
	BIOMED	P value	Interpercentile range adjusted for symmetry					
Activity preceding interventional endoscopy fellowship								
Trainees should be competent in upper endoscopy and colonoscopy.	Appropriate	Appropriate	Appropriate	9.0	0	0	0	20
Trainees should have completed training in an Accreditation Council for Graduate Medical Education (or equivalent) accredited fellowship in gastroenterology and hepatology.	Appropriate	Appropriate	Appropriate	9.0	.2	0	0	20
Structure of interventional endoscopy programs								
Trainees should have a defined percentage of their effort and time devoted to supervised interventional endoscopy clinical activities, which should be no less than 80%.	Appropriate	Appropriate	Appropriate	9.0	.7	0	2	18
Trainees are encouraged to develop and execute a mentored original research study.	Appropriate	Appropriate	Appropriate	7.0	1.2	1	5	14
Trainees should be encouraged to attend a defined minimum number of institutional conferences (when available) on topics relevant to interventional endoscopy.	Appropriate	Appropriate	Appropriate	8.0	1.0	0	2	18
An AEFPP should have a minimum number of trainers performing training in interventional endoscopy (Agreed threshold, 2).	Appropriate	Appropriate	Appropriate	9.0	1.1	1	3	16
An AEFPP must offer training in both EUS and ERCP.	Appropriate	Appropriate	Appropriate	9.0	.5	0	1	19
An AEFPP must offer training in EMR.	Appropriate	Appropriate	Appropriate	8.5	.9	0	1	19
Trainees should undergo competency assessments using validated tools (when available) at regular intervals and with documented feedback.	Appropriate	Appropriate	Appropriate	9.0	1.0	1	1	18
AEFP directors should report on the number of trainers and trainees on the AEFPP match website.	Appropriate	Appropriate	Appropriate	9.0	0	0	0	20
Trainees should track outcomes related to participated procedures.	Appropriate	Appropriate	Appropriate	9.0	.3	0	0	20
Trainees should have a basic understanding of radiation safety and interpretation of fluoroscopy.	Appropriate	Appropriate	Appropriate	9.0	.2	0	0	20

AAFP, Advanced endoscopy fellowship program.

TABLE 2.
Appropriate measures for standards for interventional endoscopy fellowship programs: ERCP training

Statement	Appropriateness according to specific method		Median	Mean absolute deviation from the median	Count in 1-3 range	Count in 4-6 range	Count in 7-9 range	
	BIOMED	P value						Interpercentile range adjusted for symmetry
Activity preceding interventional endoscopy fellowship: ERCP measures								
All ERCP trainees should also have received or be undergoing EUS training.	Appropriate	Appropriate	Appropriate	9.0	.8	0	3	17
Trainees should have a minimum number of ERCP procedures that include meaningful hands-on exposure during training (Agreed threshold, 200).	Appropriate	Appropriate	Appropriate	9.0	0	0	0	20
Before an assessment of competence, a trainee should have participated in a minimum number of ERCsPs with hands-on exposure (Agreed threshold, 150).	Appropriate	Appropriate	Appropriate	9.0	.8	0	2	18
Before an assessment of competence, a trainee should have participated in a minimum number of ERCsPs with hands-on exposure in patients with a native papilla (Agreed threshold, 50).	Appropriate	Appropriate	Appropriate	9.0	.8	0	3	17
Before an assessment of competence, a trainee should have performed a minimum number of sphincterotomies (Agreed threshold, 25).	Appropriate	Appropriate	Appropriate	9.0	.6	0	3	17
An ERCP trainee should track technical quality metrics such as the ability to cannulate independently during their training.	Appropriate	Appropriate	Appropriate	9.0	.5	0	0	20

TABLE 3.
Appropriate measures for standards for interventional endoscopy training programs: EUS training

Statement	Appropriateness according to specific method		Median	Mean absolute deviation from the median	Count in 1-3 range	Count in 4-6 range	Count in 7-9 range
	BIOMED	P value					
EUS training							
All EUS trainees should have received or be undergoing ERCP training.	Appropriate	Appropriate	9.0	.9	0	3	17
Trainees should have a minimum number of EUS procedures with hands-on exposure (Agreed threshold, 200).	Appropriate	Appropriate	9.0	0	0	0	20
Before an assessment of competence, a trainee should have participated in a minimum number of EUS procedures with hands-on exposure (Agreed threshold, 150).	Appropriate	Appropriate	9.0	.4	0	2	18
Before an assessment of competence, a trainee should have participated in a minimum number of EUS procedures with hands-on exposure in patients for pancreaticobiliary indications (Agreed threshold, 50).	Appropriate	Appropriate	9.0	.4	0	2	18
Before an assessment of competence, a trainee should have participated in a minimum number of EUS procedures with FNA and/or fine-needle biopsy sampling (Agreed threshold, 25).	Appropriate	Appropriate	9.0	.4	0	1	19
Trainees should track EUS-specific quality metrics including EUS-guided FNA and/or fine-needle biopsy sampling adequacy rate.	Appropriate	Appropriate	9.0	1.0	1	3	16
Trainees should track EUS-specific quality metrics including EUS-guided FNA and/or fine-needle biopsy sampling diagnostic yield of malignancy.	Appropriate	Appropriate	9.0	.7	0	1	19

TABLE 4.
Appropriate measures for standards for interventional endoscopy training programs: EMR and luminal stent placement training

Statement	Appropriateness according to specific method			Median	Mean absolute deviation from the median	Count in 1-3 range	Count in 4-6 range	Count in 7-9 range
	BIOMED	P value	Interpercentile range adjusted for symmetry					
EMR training								
For EMR trainees, AEFPs should have a minimum number of trainers who participate in hands-on training (Agreed threshold, 2).	Appropriate	Appropriate	Appropriate	9.0	1.3	1	4	15
Trainees learning EMR should be trained in upper and colon EMR.	Appropriate	Appropriate	Appropriate	9.0	.2	0	0	20
Trainees learning upper EMR should also be trained in ablative therapies.	Appropriate	Appropriate	Appropriate	9.0	.6	0	2	18
Trainees must also demonstrate competency in electrosurgical principles.	Appropriate	Appropriate	Appropriate	9.0	.5	0	2	18
Trainees should have a minimum of EMR procedures (upper GI and colon) with hands-on exposure during training (Agreed threshold, 20).	Appropriate	Appropriate	Appropriate	9.0	.3	0	1	19
Before an assessment of competence, a trainee should have participated in a minimum number of upper and lower EMRs with hands-on exposure (Agreed threshold, 10).	Appropriate	Appropriate	Appropriate	9.0	.5	0	1	19
Trainees should track quality metrics from EMR procedures that include independent and complete resection rates.	Appropriate	Appropriate	Appropriate	9.0	.4	0	0	20
Luminal stent placement								
For luminal stent placement, AEFPs should have a minimum number of 2 trainers who participate in hands-on training.	Appropriate	Appropriate	Appropriate	9.0	2.1	4	2	14
Trainees learning luminal stent placement should be trained in esophageal, gastroduodenal, and colonic stents.	Appropriate	Appropriate	Appropriate	9.0	.2	0	1	19
Trainees should have a minimum number of luminal stent placement procedures with hands-on exposure during training.	Appropriate	Appropriate	Appropriate	9.0	.2	0	0	20
Before an assessment of competence, a trainee should have participated in a minimum number of 10 luminal stent placement procedures with hands-on exposure.	Appropriate	Appropriate	Appropriate	9.0	.9	0	3	17
Before assessment of competence, a trainee should demonstrate an understanding for the indication and placement of additional stents and retrieving/repositioning migrated stents.	Appropriate	Appropriate	Appropriate	9.0	.3	0	1	19

AEFP, Advanced endoscopy fellowship program.