



ORIGINAL ARTICLE

Strong performance on the Progressive Evaluation of Competency fellowship final examination predicts American Board of Pathology Certification

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Introduction The Progressive Evaluation of Competency (PEC) program was developed to help cytopathology fellowship directors evaluate the progress of fellows before program completion. There are no data on how PEC examination results compare with American Board of Pathology (ABP) certification status.

Materials and methods PEC final examination results from the 2011/2012 academic year were compared with performance on the ABP cytopathology examination. The total and section PEC scores were compared with ABP scaled written and practical scores, and individuals who failed the certification examination were analyzed in detail.

Results Of the 103 fellows who took the final PEC examination in spring of 2012, 88 took the ABP examination, and 79 became certified. The total and the fine-needle aspiration scores on the PEC exam were positively and significantly correlated with performance on both ABP exam sections. Every fellow who scored in the upper one-third on the PEC exam became certified. The failing candidates scored significantly lower in both total scores and the fine-needle aspiration section of the PEC exam.

Conclusions The PEC final examination performance is positively correlated with ABP certification status, and fellows who score in the top one-third of the PEC examination become certified. These findings can help provide guidance to both fellowship directors and fellows on competency and readiness for board certification.

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The American Society of Cytopathology (ASC) has administered the Progressive Evaluation of Competency (PEC) program for cytopathology fellowship programs since the 2007/2008 academic year. In 2008/2009, the PEC started offering a similar program to pathology residency programs. The goals of the PEC program are to help program directors evaluate, monitor, and ensure the competencies of their enrolled trainees before issuing a certificate of training completion.

The PEC program is available to cytopathology fellowship program directors who are also ASC members and who register all of their enrolled fellows. The PEC program for fellows provides 3 online examinations that track baseline, mid-year, and final level of medical knowledge. The test is open for an interval of 2 weeks and is administered in August, January, and May of each academic year. Topics covered include gynecologic, nongynecologic, fine-needle aspiration (FNA), ancillary techniques, and laboratory operations. Over time, the majority of questions have been field-validated with known performance. The program director receives general and comparative statistical performance measures so that the results can be reviewed with each fellow.

The American Board of Pathology (ABP) cytopathology subspecialty examination consists of a 170-question practical examination and a 130-question written examination.¹ The entire examination takes 1 day to complete. The practical examination includes 128 items with images and 42 microscopic or virtual questions; very few virtual slide questions were used in the 2012/2013 academic year. All new questions, which are single-best-answer format style, must be reviewed by the ABP Cytopathology Test Development and Advisory Committee prior to use on an examination. A mixture of new questions and questions with prior examination statistics compose each examination.

Each candidate for certification must pass both the practical and written examinations at a single examination administration given each fall. The ABP examinations are graded using criterion-referenced standards in which a standard-setting committee of experts determines in advance the expected mastery of the subject matter and the pass point. Benchmark scales allow the use of new examination items; this criterion-referenced method means that every candidate can theoretically pass the examination if sufficient performance is demonstrated. The examination uses logit-scaled scores that calculate candidate ability and item difficulty from raw scores. Examinations are equated for difficulty across years so that the passing standard stays the same, and this pass point is translated to a scaled score of 500. The 2010 standard-setting panel used a modified Angoff method to construct a referenced standard for each examination²; typically standard setting occurs every 5 years. Following each examination administration, some items may be removed from scoring based on Rasch model item statistics³; generally <10% of items are removed in any examination administration. Scores are scaled and a minimum score of 500 is required to pass for all types of ABP examinations.

Each ABP examination is constructed based on a blueprint that gives approximate percentages of questions in each topic or organ category. For example, recent practical examinations include about 20% gynecologic, about 25% nongynecologic, and 55% FNA and special stain questions.⁴ The written examination has about 30% gynecologic, 15% nongynecologic, 25% FNA, and 30% laboratory administration, techniques, stains, and special procedure questions.

The goal of this study was to determine how well the PEC exam predicts performance on the ABP cytopathology certifying examination.

Materials and methods

The PEC final examination results from the 2011/2012 academic year were the basis for this comparative study. This examination was administered from April 30 to May 22, 2012 to fellows who were expected to graduate from programs. The examination is intended to be a secure examination and consists of 100 questions to be answered in 2 hours in the following categories: 25% gynecologic, 20% nongynecologic, 25% FNA, 20% ancillary tests, and 10% laboratory operations. This blueprint is very similar but not identical to the ABP examination. An ASC staff member provided data to an ABP trustee in a confidential manner. The ABP trustee (Davey) provided the PEC spreadsheet to an ABP staff member to correlate the PEC information to the ABP test results. At this time, all of the identifying information was permanently removed so that the authors had access only to the score details without any identifiers. The results were analyzed 2 ways. First, the overall PEC score was compared with the scaled score on both the written and practical ABP cytopathology subspecialty examinations. Next those individuals who failed 1 or both sections of the ABP examination were compared with individuals who passed both sections of the examination and became certified. Statistical analyses were performed on Excel (*t* tests; Microsoft) and SPSS (Pearson correlation; IBM) software. This study was judged by the authors to be exempt from institutional review board review based on federal regulation 45 CFR 46.101(b)(2), which includes research involving the use of educational tests. None of the data in this study can be linked to a human subject.

Results

The PEC final examination was completed by 103 cytopathology fellows in the spring of 2012. The total PEC score ranged from 62% to 88%, with a mean score of 76%. The examination is scored separately for gynecologic, nongynecologic, FNA, ancillary, and laboratory operations sections (Table 1). The median and mean scores for the nongynecologic and ancillary sections of the exam were higher than for other sections. The laboratory operations section showed the lowest mean score and was significantly

Table 1 Progressive evaluation of competency final examination results.

Exam results	Total	GYN	NG	FNA	ANC	LO
Mean (%)	76	75	86	69	86	60
Standard deviation	5.6	9.4	7.7	8.4	9.2	13
Coefficient of variation	0.074	0.125	0.090	0.122	0.107	0.217
Median (%)	76	75	86	68	89	60

Abbreviations: GYN, gynecologic; NG, nongynecologic; FNA, fine-needle aspiration; ANC, ancillary testing; LO, laboratory operations.

lower than the total PEC score ($P < 0.0001$); this section also had the highest coefficient of variation, but it accounted for only 10% of the questions. The total PEC score correlated with each individual PEC section, but individual sections were not highly correlated to each other (Table 2).

Of the 103 fellows who took the ASC PEC final examination in 2011 or 2012, 88 of them took the ABP certifying examination in 2012 or 2013. The ABP practical examination scores ranged from 469 to 638 (median score 546, passing score 500), whereas the written examination scores ranged from 483 to 655 (median 575, passing score 500). Performance on the written and practical ABP examinations was positively correlated for the 88 candidates in this study ($r = 0.69$, $P < 0.0001$) (Table 2). The total PEC score was also significantly correlated with performance on the ABP practical and written examinations ($r = 0.41$ and 0.42 , respectively; $P < 0.0001$). Performance on the FNA portion of the PEC examination was also positively and significantly correlated with performance on both the ABP practical and written examinations.

Nine of 88 candidates failed 1 or both sections of the ABP certifying examination (10.2%). Three failed both sections; 5 failed the practical section only; and 1 failed only the written section. The total PEC scores for the failing candidates ranged from 65% to 79%. Every fellow who scored in the upper one-third of all fellows (at least 80%) on the PEC examination passed the ABP certifying examination. There were only 2 failures in the fellows that scored above the median on the PEC exam.

The PEC performance of the 9 failing candidates on ABP examination was compared with the 79 who became certified by the ABP (Fig. 1). The total and FNA PEC examination results were significantly different for those who passed versus failed ($P = 0.02$ and 0.002 , respectively). Five of the 9 failing candidates had FNA subsection scores of ≤ 60 . Although there were trends for other sections, no others reached statistical significance, given the small number of failing candidates and small number of questions in some of the PEC sections. The ABP provides failing candidates with information on their performance in various subsections of the examination by reporting whether they scored in the upper, middle, or lower third for each section. The failing candidates scored in the lower one-third of candidates for the majority of ABP examination subsections.

Discussion

Previous studies have correlated results of resident performance on in-training (in-service) examinations with success on written board certification examinations.⁵⁻⁷ Most of these studies have found a significant correlation, especially when the composite or overall score of the in-training examination is compared with that of certification. The correlation is strongest during the last part of the training period, and there is weaker correlation when subsections of the examination are compared. Whereas many of the studies have compared performance in other specialty fields, Rinder et al⁶ have examined the correlation between the pathology Resident In-Service Examination administered by the American Society for Clinical Pathology and ABP certification. We know of no studies that compare performance for subspecialty pathology training examinations and subspecialty pathology certification.

This study of fellowship examination and certification confirms previous research analyzing primary specialties including pathology. We showed a positive correlation between overall PEC performance and performance on both the written and practical sections of the ABP certification examination. In addition, the final PEC score was predictive of board certification: every fellow who scored in the upper one-third on the PEC examination became certified, and only

Table 2 Correlations between Progressive Evaluation of Competency total and section scores and American Board of Pathology written and practical exams.

Exam type	Total	GYN	NG	FNA	ANA	LO	ABP written	ABP practical
Total		0.75	0.56	0.65	0.64	0.41	0.42	0.41
GYN	0.75		0.18	0.31	0.41	0.18	0.33	0.27
NG	0.56	0.18		0.24	0.16	0.26	0.10	0.12
FNA	0.65	0.31	0.24		0.27	0.00	0.47	0.52
ANA	0.64	0.41	0.16	0.27		0.11	0.23	0.28
LO	0.41	0.18	0.26	0.00	0.11		0.07	-0.06
ABP written	0.42	0.33	0.10	0.47	0.23	0.07		0.69
ABP practical	0.41	0.27	0.12	0.52	0.28	-0.06	0.69	

Abbreviations: ABP, American Board of Pathology; other abbreviations as in Table 1.

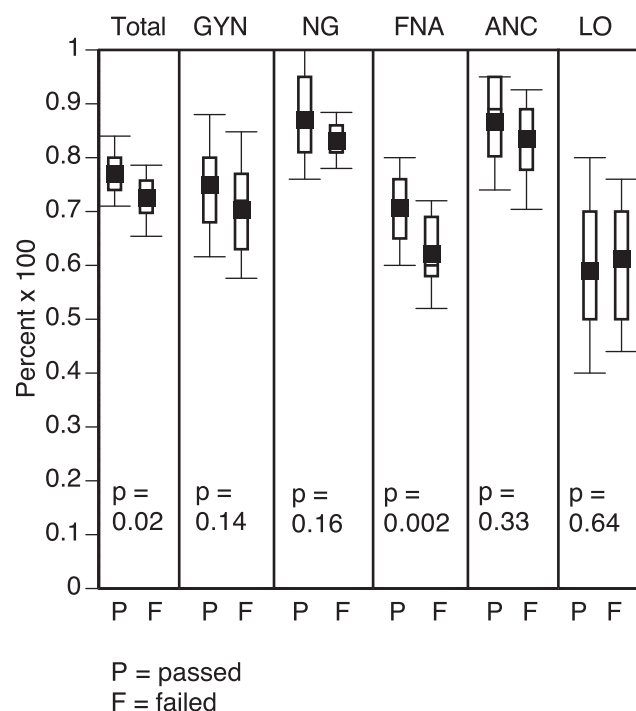


Figure 1 Performance of passing versus failing board candidates on final progressive competency examination results according to total score and individual sections. Those fellows who became certified by the American Board of Pathology are shown as “P,” whereas failing candidates are indicated by “F.” Abbreviations: GYN, gynecologic; NG, nongynecologic; FNA, fine-needle aspiration; ANC, ancillary testing; LO, laboratory operations.

2 fellows who scored above the median failed the ABP examination. These findings should help cytopathology program directors evaluate their fellows and provide guidance on how to study for board examinations. If every fellow takes all 3 examinations, the PEC exam could potentially be integrated in the assessment of the cytology fellowship milestones. Furthermore, the training curriculum could be modified as necessary for a struggling fellow based on the initial and mid-year examination scores, thus allowing ample time to prepare the fellow prior to the board exam.

When specific PEC sections were analyzed, the FNA category showed the strongest correlation to ABP certification. The FNA category accounted for 25% of the questions on the PEC exam and was also one of the more challenging sections, with a median score of 68%. The next largest sections of the PEC exam were not statistically predictive of ABP performance but had much higher median and mean scores. When question challenges are easy for participants, they may not adequately discriminate between borderline and competent mastery of knowledge. For this reason, items in most board certification examinations are targeted so that the percentage of individuals who get an item correct is similar to the pass point of the examination.³ In the future, if other sections of the PEC exam that are currently easy include more challenging questions, they may also become more predictive of ABP performance.

The laboratory operations section had the lowest PEC scores, the highest coefficient of variation, and the lowest correlations with both ABP examination performance and other PEC examination sections. Of note, the failing candidates performed slightly better in the laboratory operations section, although this result was not statistically significant. Although this section had only 10% of questions, the variability in performance may indicate inconsistency in coverage of these topics in fellowship training. Another explanation is that the laboratory operations questions are not representative of the topics covered on the ABP board examination.

The ABP examination provides failing candidates with some data on how they performed compared to other candidates on subsections. Failing candidates frequently scored in the lower one-third of candidates on the subsections, but we did not attempt to further analyze the data. The ABP examination currently includes both written and practical sections, and there are several FNA subdivisions. Although there are many similarities in the PEC and ABP examination blueprints, the various sections do not correlate exactly. In the future, the ABP will be combining the written and practical examinations, and scoring the entire examination together. The ASC may wish to align the PEC subcategories more closely to the ABP subcategories when the written and practical blueprints are combined, and they might want to include similar percentages of items of each subcategory. In the ABP examination, some of the ancillary testing questions specific to an organ tract are included with gynecologic, nongynecologic, and FNA categories, whereas more general methodology questions are grouped with laboratory administration. Laboratory administration questions account for a substantial number of questions on the current ABP written examination. Consideration should be given to review and expand these items on the PEC exam as they currently account for only 10% of the exam and show poor correlation with other assessment measures.

This study is limited by the single year of PEC data analyzed, and additional future analyses correlating data over several years will be useful to determine whether these trends continue. Also, some of the PEC participants may have prepared differently for the PEC final examination; some of the fellows may have studied whereas others may not have prepared. Finally, the PEC examination administration may have varied in different fellowship programs. Although it is intended to be a proctored secure examination, the ASC has no control over whether some fellows are allowed to consult books or resources. Both the ABP and the PEC examinations mainly evaluate medical knowledge with a smaller component of patient care assessment and other training competencies. Thus, both examinations have limitations in predicting the professional success of the individual cytopathologist.

In summary, fellow performance on the PEC examination positively predicts future performance on the ABP cytopathology certification examination and will be useful to program directors in evaluating competencies and milestones and to fellows in targeting topics for additional study.

Conflict of interest disclosures

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