Senior Pathology Resident In-Service Examination Scores Correlate With Outcomes of the American Board of Pathology Certifying Examinations

Henry M. Rinder, MD, Margaret M. Grimes, MD, MEd, Jay Wagner, MBA, MLS(ASCP), and Betsy D. Bennett, MD, PhD; for the RISE Committee of the American Society for Clinical Pathology and the American Board of Pathology

Key Words: In-training examination; In-service examination; Board certification; Medical knowledge; Board passing rates; Pathology graduate medical education

DOI: 10.1309/AJCPA7O4BBUGLSWW

Abstract

The Resident In-Service Examination (RISE) addresses 1 area of the Accreditation Council for Graduate Medical Education Outcome Project; RISE results demonstrate progressive attainment of pathology knowledge during training. We compared RISE scores with primary pathology board certification success for residents graduating in 2008 and 2009. Overall RISE and nearly all sectional scores in anatomic and clinical pathology were significantly higher for residents passing all certifying examinations at the first attempt vs residents who failed any examination. The risk of failing increased with each lower quartile of overall RISE score, such that 34% (2009) and 54% (2008) of residents in the lowest quartile failed at least 1 certifying examination. Two thirds of graduating residents with lowest quartile scores had a similar quartile ranking in the previous RISE, identifying them as at risk. Residents passing the American Board of Pathology certifying examinations have a higher level of medical knowledge in general and specific pathology disciplines as assessed by senior RISE scores.

The American Society for Clinical Pathology (ASCP) Resident In-Service Examination (RISE) has been given annually since 1983; 100% of United States residency programs currently participate, and Canadian and other international pathology training programs have participated. All residents in all years of pathology residency training take the examination, which is available during a 2-week period in early spring. There are more than 350 multiple-choice questions in a “one-best-answer” format, and each year’s RISE is unique. The RISE is developed in collaboration with the Academy of Clinical Laboratory Physicians and Scientists, the Association of Directors of Anatomic and Surgical Pathology, the American Association of Blood Banks, the American Association of Neuropathology, the American Pathology Foundation, the American Society for Apheresis Graduate Medical Education Resources Subcommittee, the National Association of Medical Examiners, the Society for Hematopathology, and the Society for Pediatric Pathology.

The usefulness of the RISE has expanded from self-assessment after the Accreditation Council for Graduate Medical Education introduced its Outcome Project in 2000, and in 2003, ASCP converted the RISE to a Web-based format. The focus of accreditation by the Accreditation Council for Graduate Medical Education is now centered on a training program’s accomplishments, including board passing rates and in-service examination scores. Thus, since 2003, the RISE has been used by program directors as an assessment tool for medical knowledge gained during pathology residency training. The RISE tests medical knowledge in anatomic pathology (AP), clinical pathology (CP), and special topics (ST) common to AP and CP. AP/CP residents take all 3 sections, whereas AP-only residents take
the AP and ST sections and CP-only residents take the CP and ST sections. The 3 sections of the RISE comprise 10 content areas. The AP section is allotted 2 hours and 15 minutes for 3 content areas: surgical pathology (20% of total content), cytopathology (12%), and autopsy/forensic pathology (10%). The CP section is allotted 2 hours and 45 minutes and consists of 4 content areas: clinical chemistry (11%), hematology (11%), microbiology (11%), and transfusion medicine (11%). The ST section is allotted 1 hour and consists of 3 content areas common to AP and CP resident training: hematopathology (4%), laboratory administration (5%), and molecular pathology (5%).

The examination is scored using a Rasch norm-referenced model of analysis, and the measurement is then converted to a scaled score. This scaled score is a linear transformation of the raw measure that is comparable across years and examinees with 999 being the highest and 100 the lowest reportable score. There are no passing scores. Scores are based only on the sections attempted. Residents receive scores and percentile equivalents in comparison with their peer training group (postgraduate year 1, 2, 3, or 4) for each of the 10 content areas and for the total examination. A list of descriptors for each question (which details the specific knowledge being tested) and a reference are provided along with each resident’s corresponding list of missed questions. Program directors receive each individual resident’s report plus programmatic mean scores, standard deviations, trending reports, and percentile equivalents for each content area and for each year of training, all with comparisons with the national peer group.

The RISE has consistently demonstrated the overall progression of attainment of medical knowledge during pathology residency training similar to other disciplines, but RISE results have not been formally compared with future accomplishments of pathology trainees, eg, success in attaining board certification. The spring RISE is given in March to ensure that results are available to graduating residents taking their primary pathology certifying examinations in the following May or June, partly to highlight any knowledge gaps for concentrated study, but also to reassure graduating seniors before the boards that their RISE-assessed progress is keeping pace with nationally measured peers. This reassurance would be reinforced if RISE results were shown to correlate with success on the pathology certifying examinations.

The American Board of Pathology (ABP) administers 2 primary certification examinations, 1 in AP and 1 in CP. Applicants may certify in both (AP/CP certification) or in either area alone (AP only or CP only). Applicants choosing to certify in AP/CP may take both examinations during the same administration or may take the AP and CP examinations at separate administrations. AP/CP candidates are not certified until both parts of the examination have been passed and all other requirements have been met. All AP and CP examinations are graded in the same manner and have the same pass-fail standard, regardless of whether the candidate is taking one or both tests.

The AP examination consists of 324 questions and is separated into 2 parts, written and practical (images, glass slides, and virtual slides). A candidate must pass both parts of the examination at the same administration. The written portion (2 hours and 15 minutes) consists of 141 questions, while the microscopy portion has 75 slides (50 glass and 25 virtual) for which 3 hours and 30 minutes are allotted. The image portion has 108 questions to be completed in 1 hour and 45 minutes. The CP examination is composed of 350 questions. The written portion (130 questions) is administered over 2 hours. The practical portion is divided into an image section (110 questions in 2 hours) and a practical examination (eg, interpretive questions and cell panels) with 110 questions given in 3 hours and 15 minutes. As with the AP examination, a candidate must pass the written and practical portions of the CP examination at the same administration. All questions are in the one-best-answer format, and both certifying examinations are graded using the criterion-reference method. Scores are scaled, and a score of 500 is required to pass. Candidates who pass the examination are not given their scores. Candidates who fail are given their scores and a breakdown of performance on the various portions of the examination.

We correlated RISE scores for graduating residents in 2008 and 2009 with the corresponding outcomes of their first attempt at passing the primary certifying examinations in AP and/or CP.

Materials and Methods

This study was judged by the investigators to be exempt from institutional review board review based on federal regulation 45 CFR 46.101(b)(2), which covers research involving the use of educational tests. In compliance with that regulation, none of the recorded or published information can be linked to any human subject, directly or through identifiers.

The database of 2008 and 2009 individual ASCP RISE results for graduating residents, ie, the data from each resident’s final RISE examination, was encoded in a password-protected format and delivered to 1 trustee of the ABP. These data comprised residents completing AP/CP, AP-only, and CP-only training. Results from the ABP database were added as “pass” or “fail” for all first-time attempts at the AP and/or CP certifying examinations in 2008 and 2009. Residents who elected to take their AP and CP certifying examinations at different times during this period were included. Second or later attempts at the certifying examinations were excluded.
The final database had all identifying information erased permanently before saving in Microsoft Excel (Microsoft, Redmond, WA) format with password protection.

Certifying examination outcomes were grouped in 2 ways: (1) passing all examinations attempted vs failing any certifying examination and (2) passing vs failing the specific AP or CP certifying examination. RISE results were similarly grouped as follows: (1) the overall score for the entire RISE examination and (2) the individual RISE section scores specific for the AP (autopsy/forensics, cytopathology, and surgical pathology) and CP (chemistry, hematology, microbiology, and transfusion medicine) disciplines. Comparisons between groups were examined for statistical significance (P < .05) using the unpaired t test. Besides mean scores, overall RISE results were also analyzed by their percentile ranking to determine the risk for failing a certifying examination by overall RISE quartiles. To correlate a single comparison of year-year lowest quartile performance, a blinded post hoc analysis was performed to examine the 2007 and 2008 RISE results for all 2008 graduating residents.

Results

A total of 454 residents graduating in 2008 and 424 graduating in 2009 were first-time takers of the 2008 and/or 2009 ABP certifying examinations in AP and/or CP and had evaluable data from their senior RISE in the spring of 2008 or 2009.

Mean RISE Scores and Certifying Examination Outcome

Mean overall RISE scores were significantly higher (by 55 and 59 points) for graduating residents in 2008 and 2009, respectively, who subsequently passed all of their attempted ABP examinations (including AP and CP, AP only, and CP only) vs residents who failed any ABP examination (Table 1). A similar difference in the overall 2008 and 2009 RISE scores was noted when the data were separated by residents who specifically failed the AP (60 and 61 points, respectively) or the CP (54 and 61 points, respectively) component of the certifying examination (Table 1). Although mean scores within passing and failing groups differed somewhat from year to year, the percentile for that mean value was remarkably similar between 2008 and 2009, further supporting the RISE emphasis on percentiles for comparing residents with peers.

When mean sectional 2008 RISE scores were examined for the 3 AP-specific disciplines (Figure 1A), the mean scores for the cytopathology and surgical pathology sections were significantly higher for the residents who passed the AP certifying examination vs residents who failed. By contrast, there was no significant difference in autopsy/forensic pathology scores between the pass and fail groups. The mean difference in cytopathology scores (65 points) for passing vs failing the AP certifying examination was similar to the mean difference in the overall RISE (55 points), but mean surgical pathology section scores were 100 points higher for passing residents than for residents who failed (Figure 1A).

Similar differences in mean scores were noted for 2009 (Figure 1B), with surgical pathology again having the largest difference between groups, followed by cytopathology and, finally, autopsy/forensic pathology demonstrating a marginal (albeit significant) difference. The mean surgical pathology and cytopathology scores in 2008 and 2009 for the resident group failing the certifying examination were consistently below the range of 2nd quartile scores for passing residents, suggesting that residents in the bottom quartile of scores are at greater risk for failing (Table 1 and Table 2).

Similarly, residents who passed vs failed the CP certifying examination demonstrated consistently significant differences in all 4 CP-specific disciplines of the 2008 (Figure 2A) and 2009 (Figure 2B) RISE. The differences between the mean scores for the 4 sections ranged from 47 to 77 points.

Table 1

<table>
<thead>
<tr>
<th>ABP Certifying Examination Outcome</th>
<th>2008 RISE Score</th>
<th>Percentile for the Mean Score</th>
<th>2009 RISE Score</th>
<th>Percentile for the Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passed all examinations</td>
<td>545 ± 39† (364 [80])</td>
<td>65th</td>
<td>506 ± 40† (382 [90])</td>
<td>65th</td>
</tr>
<tr>
<td>Failed any examination</td>
<td>490 ± 35 (90 [20])</td>
<td>20th</td>
<td>447 ± 25 (42 [10])</td>
<td>20th</td>
</tr>
<tr>
<td>AP examination</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passed</td>
<td>540 ± 41† (392 [91])</td>
<td>60th</td>
<td>504 ± 41† (365 [96])</td>
<td>60th</td>
</tr>
<tr>
<td>Failed</td>
<td>480 ± 36 (40 [9])</td>
<td>15th</td>
<td>443 ± 28 (17 [4])</td>
<td>20th</td>
</tr>
<tr>
<td>CP examination</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passed</td>
<td>545 ± 39† (352 [84])</td>
<td>65th</td>
<td>508 ± 38† (351 [92])</td>
<td>65th</td>
</tr>
<tr>
<td>Failed</td>
<td>491 ± 36 (67 [16])</td>
<td>20th</td>
<td>447 ± 26 (30 [8])</td>
<td>20th</td>
</tr>
</tbody>
</table>

ABP, American Board of Pathology; AP, anatomic pathology; CP, clinical pathology; RISE, Resident In-Service Examination.

* Data are given as mean ± SD (number [percentage] of residents).
† P < .001 compared with failed.

© American Society for Clinical Pathology
Figure 1 Mean sectional 2008 (A) and 2009 (B) Resident In-Service Examination (RISE) scores for the anatomic pathology (AP)-specific disciplines for residents who passed vs failed the AP certifying examination. For the 2008 and 2009 RISE, passing residents had significantly higher cytopathology and surgical pathology scores \((P < .001)\); by contrast, autopsy/forensic pathology scores did not differ between groups \((P = .066)\) in 2008 and, although significantly different in 2009 \((P = .03)\), were much less disparate than the scores for cytopathology and surgical pathology. Max, maximum; Min, minimum; Q1, quartile 1; Q3, quartile 3.
Analogous to the RISE surgical pathology and cytopathology scores, the mean CP section scores for the resident group that failed the certifying examination were consistently below the range of 2nd quartile scores for passing residents. Only the microbiology mean score for failing residents in 2008 approximated the lower scoring range of the 2nd quartile for passing residents.

**Passing Rates for the ABP Certifying Examinations and Overall RISE Percentile Results**

When individual residents were ranked according to their overall 2008 RISE score quartile, the rate of passing all certifying examinations declined with each lower quartile ranking (Table 2), such that fewer than half of 2008 graduating residents in the bottom quartile passed all of their certifying examinations. In a post hoc analysis, we found that slightly more than two thirds (69%) of 2008 graduating residents who were in the lowest quartile for the 2008 RISE were also in the lowest quartile for their 2007 RISE scores.

A decline in passing rates with lower RISE quartiles was also noted for 2009 graduating seniors (Table 2), but the certifying examination passing rates in each quartile were somewhat higher than those for 2008. This difference between graduating years 2008 and 2009 is important to note in light of the difference in passing rates for the ABP certifying examination in CP during those 2 years: 82% in 2009 compared with 75% in 2008; the AP passing rate was similar for both years. Still, the data demonstrate that graduating residents scoring in the bottom quartile of the RISE are at particular risk of failing a certifying examination; based on our post hoc analysis, it may be possible to identify residents who fall into this at-risk group based on their previous “junior year” RISE percentile rankings.

**Discussion**

There is a body of work that has assessed whether the results of in-training examinations of residents’ medical knowledge predict success on the corresponding certifying examination, ranging from single department reviews to studies conducted by the board or specialty society. Most have limited their correlation to the in-training score with the written portion of a multipart certification exam, whereas some have incorporated training demographics as additional potential predictors of success. Of the 14 studies we identified in the literature, a significant correlation between in-service scores and certifying examination results was found in all but 1. This correlation tended to be strongest for the composite or overall in-service score and weaker for sectional or specialty scores within the in-service test. When the predictive value of in-training examination results for certifying success was studied, there was clear evidence that the strongest values were found in later years of training. For these reasons, the current study was designed to examine the correlation for overall and sectional RISE scores for graduating residents on their first attempt at either or both of the 2 primary pathology certifying examinations.

Our analysis of RISE scores for 2008 and 2009 graduating residents and the outcomes of their 2008 and 2009 AP certifying examinations revealed a clear difference in both total and nearly all of the discipline-specific RISE section mean scores for residents who passed vs failed any primary pathology certifying examination. Overall RISE and most sectional mean scores were between 45 and 75 points higher for residents passing the certifying examinations. These findings confirm that residents passing their certifying examination(s) have a higher level of medical knowledge in general pathology and within the AP- and CP-specific disciplines of the RISE.

We cannot rule out the possibility that the relatively consistent margins in the overall and most sectional scores between board outcome groups may additionally reflect general test-taking skills. However, RISE scores in the autopsy/forensic pathology section of AP did not differ significantly between 2008 graduates (and were very similar for 2009 graduates) who passed vs failed their first attempt at the AP certifying examination. The training experience of AP/CP and AP-only residents may be most uniform in this area.
Figure 2. Mean sectional 2008 (A) and 2009 (B) Resident In-Service Examination (RISE) scores for the clinical pathology (CP)-specific disciplines for residents who passed vs failed the CP certifying examination. For the 2008 and 2009 RISE, passing residents had significantly higher clinical chemistry, hematology, microbiology, and transfusion medicine scores ($P < .001$). Max, maximum; Min, minimum; Q1, quartile 1; Q3, quartile 3.
because of the ABP eligibility requirement of 50 autopsies or more; the vast majority of residents have participated in numbers of autopsies very close to the required number. In addition, nearly all pathology training programs include medical examiner experience or didactic forensics lectures by a medical examiner; we speculate that the impact of “interesting” and classic forensics images may leave a lasting impression reflected in board performance.

By contrast, resident training in surgical and cytopathology varies widely and is based solely on programmatic and not ABP requirements. This variation may partly explain why the surgical pathology and cytopathology AP sections consistently demonstrated large and significant differences in mean scores between residents passing and residents failing the AP certifying examination; indeed, surgical pathology demonstrated the largest gap between groups of all the RISE subdisciplines. The number of surgical/cytopathology specimens submitted on the AP application varies by several-fold among applicants, especially in cytopathology. This range, when compared with the more uniform autopsy experience, could account for the differences in surgical/cytopathology performance compared with autopsy/forensic pathology. Thus, a relatively poor RISE performance in the surgical pathology and/or cytopathology sections (scores of 50-100 points lower than the mean for peer senior residents) could be a signal of forthcoming difficulty with the AP certifying examination.

Graduating residents who scored above the overall mean for the senior RISE had very high passing rates for all attempted certifying examinations. This result is not surprising given the first-time passing rates of 85% for AP and 75% for CP certifying examinations in 2008 and higher passing rates in 2009. Passing rates for the certifying examinations declined with each quartile of overall RISE scoring, especially when RISE scores were less than the 50th percentile and even more so for the bottom quartile of RISE results. This finding is consistent with our data demonstrating that the mean overall scores for failing residents (Table 1) fall into the bottom quartile. The analysis of overall RISE scores from 2007 for residents graduating in 2008 further suggest that significant attention be given to residents who score in the bottom quartile overall and, perhaps, residents with significantly lower surgical pathology and cytopathology sectional scores.

Finally, we cannot rule out that resident study habits, which are known to affect in-training examination outcomes,20 may have accelerated before the senior RISE in anticipation of taking the certifying examinations. However, our finding of low overall RISE quartile performance as an at-risk predictor suggests that a consistent knowledge deficit is an important target for training programs to identify. Future studies of RISE results and certifying examination outcomes may yield more specific targets for training improvements by prospectively examining longitudinal RISE trends within individuals; another prospective venue might include correlating RISE scores and outcomes with specific training differences between pathology residency programs. These studies could add to the current data for identifying at-risk residents and perhaps targeting the areas of medical knowledge where focused training may improve outcomes in the ABP certifying examinations.

From the 1Department of Laboratory Medicine, Yale University School of Medicine, New Haven, CT; 2Department of Pathology, Virginia Commonwealth University, Richmond; 3Examination Development & Outcomes Assessment Products, American Society for Clinical Pathology, Chicago, IL; and 4American Board of Pathology, Tampa, FL.

Address reprint requests to Dr Rinder: Dept of Laboratory Medicine, Yale University School of Medicine, PO Box 208035, New Haven, CT 06520-8035.

References

© American Society for Clinical Pathology

DOI: 10.1309/AJCPA7O4BBUL5WW


