



ASSOCIATION OF RESIDENTS IN RADIATION ONCOLOGY

## **An Open Letter to the American Board of Radiology Regarding the 2018 Qualifying Examinations for Radiation Oncology**

The Association of Residents in Radiation Oncology (ARRO) Executive Committee and the American College of Radiation Oncology (ACRO) Resident Committee are the elected leaders of organizations representing residents nationwide in the field of radiation oncology. We write to relay concerns conveyed to us regarding the 2018 qualifying board examinations in radiation biology and physics administered by the American Board of Radiology (ABR). It is our responsibility to ensure that the debate over evaluating proficiency in training radiation oncologists includes the resident perspective. We write this letter in hopes of clarification and opening lines of communication.

Regardless of our respective titles, we all share a common interest in ensuring the process of board certification is rigorous, comprehensive, and consistent. We respect and appreciate the considerable work that the ABR performs to develop and administer these examinations. We believe that including radiation oncology trainees in this critical conversation will best accomplish our mutual goal of training and certifying competent, proficient radiation oncologists in a fair and effective manner.

The primary aims of the ABR to ensure that the administered examinations meet this objective include:<sup>1,2</sup>

1. To establish what constitutes the “requisite standard of knowledge, skill, and understanding essential to the safe and competent practice of radiation oncology.”
2. To administer qualifying and certifying examinations that accurately and consistently identify those physicians that do and do not meet this requisite burden.
3. To ensure each proctored examination is objective, fair, and psychometrically valid by demonstrating predictable and stable examination performance, content relevance, and consistency of passing standards.

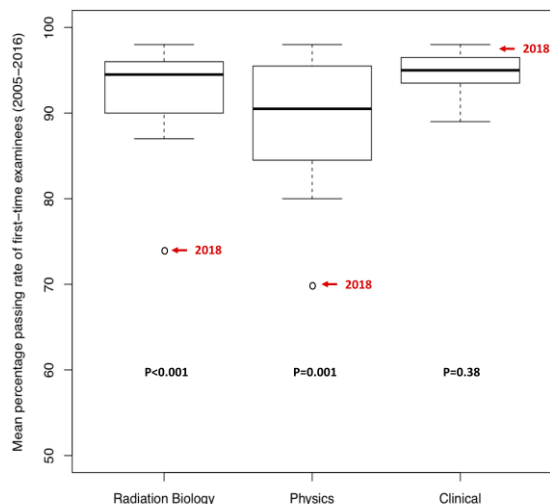
**Our ultimate goal is that the certifying body as well as each examinee and training program feel confident that qualifying examinations consistently and clearly achieve these aims. Right now, that confidence is absent.** Over the past several weeks, many residents have expressed to us both confusion and apprehension that the 2018 examinations may not have satisfied one or more of these aims. Despite a lack of change in didactic education, available study materials, or in-service exam scores, the rate of failure was significantly higher this year than in previous years for both the radiation biology and physics examinations. As a result, many feel unsure how to move forward and are disappointed regarding a lack of clarity in test scoring and expected knowledge base.

The ABR has publicly reported the percentage pass rate of first-time exam takers for the qualifying written examinations from 2005-2016 (Table 1). Historical median pass rates for first-time examinees of the radiation biology and physics examinations from 2005-2016 were 94.5% (interquartile interval [IQR], 90.5-96.0) and 89.5% (IQR, 84.8-95.3), respectively (Figure 1).<sup>3,4</sup> The pass rates for 2018 examinees were recently reported to be 74% and 70% for the radiation biology and physics examinations, respectively.<sup>5</sup> The 2018 pass rates differed by 3-5 times the standard deviation of the pass rates across the exam administrations from 2005-2016. The statistical probability that this difference occurred by chance is <0.1% ( $Z=5.1$ ,  $P<0.001$ , radiation biology), and 0.1% ( $Z=3.2$ ,  $P=0.001$ , physics). The ABR has not disclosed the number of first-time exam takers who failed at least

one section, but likely at least one-third (range: 30-56%) of all 2018 examinees will need to re-take at least one qualifying exam currently scheduled to take place one day prior to the clinical qualifying exam in 2019.

**Table 1.** Reported American Board of Radiology annual percentage pass rates for first-time exam takers of radiation biology, physics, and clinical qualifying examinations.<sup>3,4</sup>

Year	Radiation Biology	Physics	Clinical
2005	92%	84%	89%
2006	98%	92%	95%
2007	95%	85%	95%
2008	96%	95%	98%
2009	96%	89%	98%
2010	91%	90%	96%
2011	97%	96%	94%
2012	88%	80%	95%
2013	96%	91%	93%
2014	87%	81%	92%
2015	89%	98%	97%
2016	94%	97%	95%
Mean (SD)	93.3% (3.7)	89.8% (6.2)	94.8% (2.6)
Median [IQR]	94.5% [90.5-96.0]	90.5% [84.8-95.3]	95.0% [93.8-96.3]
<b>2018</b>	<b>74%</b>	<b>70%</b>	<b>97%</b>
Z-score (2018 vs 2005-2016)	5.1	3.2	-0.9
Two-sided P-value	<0.001	0.001	0.38



**Figure 1.** Boxplots of reported annual percentage pass rates of first-time test takers of the American Board of Radiology radiation biology (left), physics (center), and clinical (right) qualifying examinations from 2005-2016 [2017 unavailable]. Reported average pass rates from 2018 are plotted as outliers (for radiation biology and physics) and labeled. Two-sided P-values (with distribution of normality confirmed by the Shapiro test) demonstrate that the statistical probability of the 2018 pass rates occurring by chance is <0.1% (Z=5.1, P<0.001, radiation biology), 0.1% (Z=3.2, P=0.001, physics), and 38.0% (Z=-0.9, P=0.38, clinical).

Possible explanations for the low 2018 pass rates include: 1) The exam itself (question content, difficulty, level of detail) was different from that of previous years; 2) The scoring of the exam was different from that of previous years; or 3) The trainees or didactic training had declined in quality from previous years. While there may be multiple factors contributing to the lower pass rates of the qualifying examinations this year, in this letter we will consider each of these variables separately.

#### Exam Content

In 2013, the ABR endorsed seven psychometric standards from the Standards for Educational and Psychological Testing, and explained the mechanisms by which ABR implements these standards as part of the examination

program.<sup>2,6</sup> In support of these standards, the ABR stated its intent to “continuously monitor developments in psychometric science as well as standards in the field, and adapt its examination development and administration programs accordingly.”<sup>2</sup> Despite needing to adapt the examination periodically, the ABR states that the “reproducibility of ABR examination results is vitally important in making fair and accurate judgments regarding certification” and therefore directs “committees to achieve and maintain reliabilities of 0.90 or higher, as generally recommended for ‘high-stakes’ examinations.”<sup>2</sup>

The ABR also committed to the production of a “study guide with content outlines and sample questions,” “examination blueprints with percentages of items given in the major areas of the examinations,” and a “110-item practice examination”.<sup>2</sup> Furthermore, the ABR stated that every three years a “large scale practice analysis survey of present practitioners” is performed to both update examination blueprints and assure both content validity and relevance to contemporary practice.<sup>2</sup> The ABR website has resources for exam candidates in diagnostic radiology. Unfortunately, no comparable resources are provided by the ABR for candidates in radiation oncology.<sup>7</sup>

We have heard from multiple 2018 examinees that question content may not adequately represent study materials traditionally used by residents in preparation for previous years’ examinations. The default standard textbook, Radiobiology for the Radiologist, may not be reflective of a consistent number of questions selected by the committee for any given year.<sup>8</sup> Further compounding this, the ASTRO Radiation/Cancer Biology Practice Examination and Study Guide Taskforce did not release a 2018 study guide, leaving examinees with even fewer endorsed resources for exam preparation.

#### *Exam Scoring*

The ABR employs the Angoff method using a criterion-based reference system for determination of the passing standard for each exam. While precedent exists for the Angoff method, reliance upon this system is appropriate only if it is able to demonstrate statistical reliability. In its 2013 publication, the ABR agreed, stating that its policies “include statistical equating, where possible, to keep the level of competence required for passing equitable from one examination form to another.”<sup>2</sup> While the 2018 passing standard, defined as the line at or above which candidates will pass the exam, was within the range of passing standards reported over the previous five years, it is unclear whether this passing standard took into account individual question or examination difficulty. These standards are based upon subjective assessment by experts who “opine the number of individuals who *would* answer a specific question correctly.”<sup>5</sup> How the ABR validates these assessments of test question difficulty remains unclear.

#### *Trainee quality and preparation*

As a recent editorial from Drs. Amdur and Lee highlights, the United States Medical Licensing Exam (USMLE) scores of radiation oncology residents have been steadily increasing over the past decade despite stable or decreasing pass rates on ABR computer-based examinations.<sup>3</sup> While Dr. Wallner et al. correctly note that the examination content for the radiation biology and physics examinations are substantially different from those tested by the USMLE,<sup>9</sup> there are no current data that support such a significant and sudden decline in resident quality. If the quality of the trainee or training program were to be the significant causative variable(s) causing this effect, one would expect either a slower decline in standard examination performance over time, or for a greater concentration of failures at newer programs or those programs with a less robust didactic series. There are no data to support that assumption. We are unaware of reliable data regarding curriculum quality or its potential relationship with trainee performance on qualifying examinations. Resident physicians clearly wish to develop the proficiency necessary to practice radiation oncology, but clear expectations for preparation and a curriculum matching the qualifying examinations are essential for this to be achieved. If knowledge gaps exist, they need to be identified.

#### *Examination feedback*

A significant number of residents expressed dismay that they are unable to utilize the individual score report for the purpose of feedback and exam remediation. As the Angoff method has no “preordained” or “norm-referenced” standard for what constitutes a passing score, this threshold is an annually moving target. The feedback currently provided to examinees via norm-referenced quartiles therefore has limited informative value. Similarly, as there is limited description of which topics are included in each section, it is difficult to determine which topics require special attention when studying for a re-examination. Further perpetuating this, the lack of clear and timely publication of annual pass rates contributes to the perception of an intent to conceal examination results. To date, the ABR has not reported the percentage pass rate of first-time exam takers for 2017, nor has the ABR published the standard deviations or quartile ranges for the distribution of pass rates for any year; the reasons for omission of these data are unclear.

### *Moving Forward*

If the goal of certifying examinations is to ensure trainees are able to demonstrate competence in radiation oncology, we believe it is in the interest of all parties to work together towards a solution. Greater transparency and collaboration are essential. On behalf of residents, the ARRO Executive Committee and the ACRO Resident Committee are more than willing to do our parts to identify problems and solutions. We hope the organizations representing our educators and our examiners will do the same.

To determine how each of these factors influenced the surprising 2018 results, transparency is essential. The ABR has the ability and the opportunity to demonstrate that it meets its own stated aims by sharing its psychometric data in an appropriate format. We believe it is reasonable to expect reassurance from the ABR that it can confirm consistency in testing methods, content, and scoring while protecting the integrity of the details of the actual examination. Similarly, disclosure of the intra- and inter-rater reliabilities for the scoring of questions on both previous and future examinations as well as a description of any post-examination analysis of individual question performance would assure an examinee of the statistical rigor underlying the Angoff method and therefore the overall reliability and validity of his or her score. We also believe that greater transparency regarding a candidate’s performance on these examinations is a fair and reasonable request, including disclosure of the passing standard (i.e. raw score threshold) necessary to pass each section of the ABR examinations, explanation of the weighting of subjects within each section for scoring purposes, and significantly more comprehensive feedback regarding individual performance on specific subjects.

We ask for collaboration with both the ABR and Association of Directors of Radiation Oncology Programs (ADROP) to ensure the development of comprehensive resident curricula that match current expectations of the ABR for a candidate to be successful on the qualifying examinations. Feedback from both the ABR and training programs are essential for trainees to develop the proficiency that permits the successful demonstration of competence on qualifying examinations. Some examinees will still fail, but the opportunity for re-examination should not be delayed until just one day prior to the clinical radiation oncology written examination, which unnecessarily forces examinees to study for all three areas at once and may potentially result in insufficient preparation for any single examination. Lastly, many individuals requested that the ABR provide an additional testing date during the year for re-examination. The ABR currently offers a second mid-year examination for their diagnostic radiology constituents; it is unclear why similar consideration cannot be afforded to radiation oncology trainees. We hope that in the future the ABR would provide similar resources and testing opportunities to candidates for certification in each of the specialties and subspecialties of radiology for which the ABR conducts qualifying and certifying examinations.

*In summary, we are requesting that the ABR:*

- Provide **greater transparency** by demonstrating consistency in testing methods, content, and scoring of the qualifying examinations by the release of psychometric data collected for examination quality assurance.
- Work with ARRO and ADROP to develop **comprehensive resident curricula** that match current expectations for a candidate to be successful on the qualifying examinations.
- Ensure equitable resources and testing opportunities to candidates of all specialties and subspecialties under ABR's purview by **offering a second mid-year examination**.

The ABR has clearly expressed its commitment to the responsibility inherent to the preparation of “valid, reliable, and fair examinations.”<sup>2</sup> We wholeheartedly agree. We are proud to represent such an outstanding group of radiation oncology trainees and look forward to the forthcoming conversations between the ABR, ADROP, ARRO, and their constituencies that will help us achieve reliable results that produce competent clinicians.

*ARRO Executive Committee and ACRO Resident Committee, in representation of Radiation Oncology Residents*

## References

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