



Original Research

Does the Physical Medicine and Rehabilitation Self-Assessment Examination for Residents Predict the Chances of Passing the Part 1 Board Certification Examination?

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Abstract

Background: Each year, residents in accredited United States Physical Medicine and Rehabilitation (PMR) residency programs can take the American Academy of Physical Medicine and Rehabilitation (AAPM&R) Self-Assessment Examination for Residents (SAE-R). This 150-question, multiple-choice examination is intended for self-assessment of physiatric knowledge, but its predictive value for performance on the part 1 American Board of Physical Medicine and Rehabilitation Certification Examination (ABPMR-CE) is unknown.

Objective: To investigate the predictive value of the SAE-R in relation to the part 1 ABPMR-CE.

Design: Retrospective study.

Methods: Data were analyzed from first time takers of the part 1 ABPMR-CE during a 5-year period from 2010 through 2014 who took at least 1 SAE-R in the third or fourth postgraduate year (PGY) of residency.

Main Outcome Measurements: Raw scores from the SAE-R were compared with scaled scores on the part 1 examination. Regression models analyzed the predictive value of the SAE-R total score for each PGY level.

Results: SAE-R raw scores increased an average of 5.5 points between the PGY 3 and PGY 4 year. PGY3 SAE-R raw scores accounted for 24.8% and PGY4 SAE-R scores for 27.1% of the variance in part 1 ABPMR-CE scores ($P < .0001$). Residents who obtained a raw score greater than 80 (53% correct) on the SAE-R had an 80% or greater chance of passing the ABPMR-CE. Scores greater than 90 (60% correct) on the SAE-R were associated with a 95% chance of passing the ABPMR-CE.

Conclusion: The SAE-R scores provide some information regarding the likelihood of passing the part 1 certification examination. This study supports the SAE-R as a means of providing PMR residents with feedback regarding their level of knowledge.

Introduction

In the United States, many medical specialties offer residents the opportunity to take a national examination for self-assessment purposes, and some have reported on the relationship between in-training examinations and board certification [1-10]. In some specialties, the examination is administered by the certifying board [1,3,7] and in others by a specialty society [2,4-6,8-10].

The self-assessment examination available to physical medicine and rehabilitation (PMR) residents and the written (part 1) board examination in PMR are developed, administered, and scored by 2 independent

entities. The American Academy of Physical Medicine and Rehabilitation (AAPM&R) provides PMR residents in the United States and elsewhere with the opportunity to take a self-assessment examination during their training. The Self-Assessment Examination for Residents (SAE-R) is intended for use by residents to gauge their acquisition of knowledge. Additionally, residency programs use the information to identify curriculum strengths and weaknesses and to assess and counsel residents. The examination was not created to be used for high-stakes decisions such as promotion or graduation.

In the United States, many residents use the results of the SAE-R as well as abridged versions of previous

exams released by AAPM&R to guide their study in preparation for sitting for the part 1 American Board of Physical Medicine and Rehabilitation Certification Examination (ABPMR-CE). One previous study of 86 PMR residents who took the part 1 ABPMR-CE in 2001 found a positive correlation between self-reported scores on the senior year SAE-R and the part 1 ABPMR-CE [11].

The objective of this study was to investigate the predictive value of the SAE-R relative to performance on part 1 of the ABPMR-CE. Although the SAE-R and part 1 examinations are both constructed with multiple-choice questions, each has a different blueprint, and the degree of similarity of difficulty of the examinations is not known.

Methods

The SAE-R is developed and scored by the AAPM&R. It is offered annually in January to all PMR residency programs in the United States. Programs administer the examination in a proctored, closed-book format on a single day within a 2-day window. The examination questions are developed by a team of item writers. During the years included in this study, the examination consisted of 150 multiple-choice questions, divided equally into 10 categories of medical knowledge. Psychometric measures including equating are used to make sure the examination has stable reliability and difficulty across each year of examination. Results reported to residents and program directors include raw scores (the number of questions correctly answered) for the 10 medical knowledge categories, exam total score, and percentile rank by year of training. Residents can determine their personal improvement from year to year, compared with peers at their year of training. Program directors also receive raw scores and means for the 10 categories for the overall program and by PGY year to compare with other programs. There is no pass/fail cut off on the examination because it is meant to be used for self-assessment.

After the successful completion of residency training, PMR graduates are eligible to take the part 1 ABPMR-CE, which is offered once a year in August. The part 1 ABPMR-CE is a secure, computer-based examination administered simultaneously across the United States at secure testing centers. This examination is developed by item writers trained by the American Board of Physical Medicine and Rehabilitation (ABPMR). The examination consists of 325 multiple-choice questions with content apportioned according to an examination blueprint published on the ABPMR Web site (www.abpmr.org). Unlike the SAE-R, the part 1 ABPMR-CE has varying proportions of questions for the topics in the blueprint. Questions may include videos, tables, and pictures. Psychometric measures including equating are used to make sure the examination has stable reliability and difficulty across each year of examination. The part

1 ABPMR-CE is a criterion-referenced exam with the pass point set a priori, for each year's examination, by use of the best practice testing industry methods for standard setting techniques. Results reported to residents and program directors include an overall determination of pass/fail, a scaled total score (raw score converted to a standardized score ranging from 0 to 800), percentile rank, national mean, and scaled scores for the major blueprint categories.

This was a retrospective study. All first-time test takers of the part 1 ABPMR-CE during the 5-year period from 2010 to 2014 who took at least 1 SAE-R in the PGY3 or PGY4 (final) year of training were included in the sample. PGY 2 scores were not included because residents at that level of training would have had only 6 months of clinical training, because of wide variation in clinical experiences across residency programs in the first 6 months of training, and because previous publications have noted the strongest correlation for later years in training [1,6,7]. The ABPMR provided the AAPM&R with the names and residency programs of all first-time test-takers of the part 1 ABPMR-CE in the years 2010 through 2014. The AAPM&R provided the ABPMR raw scores from the SAE-R taken in the PGY 3 and/or 4 for these physicians. SAE-R scores from before 2010 were not included because those earlier examinations had 200 questions. All identifiers were removed from the dataset for further analysis; thus, the study protocol was judged by the Institutional Review Board of the University of Washington to be exempt from review. The study also was approved by the leadership of the AAPM&R and the ABPMR.

Data analysis was performed with IBM SPSS Statistics Software (IBM, Armonk, NY). Descriptive statistics for SAE-R and part 1 ABPMR-CE scores were calculated. Linear regression models were conducted for the 2 years of training, with the SAE-R scores used as predictor variables and the part 1 ABPMR-CE score as the dependent variable. Passing rates on part 1 were plotted for increments of SAE-R raw scores by year of training.

Results

There were 1938 physicians who took the part 1 examination for the first time in the years 2010 through 2014, and PGY 3 and/or PGY 4 SAE-R scores were available for 1640 (85%) of these. Descriptive statistics for the SAE-R and part 1 ABPMR-CE scores are provided in Table 1. The sample size for the SAE-R scores varies primarily because 2010 test takers would have been PGY3 residents in 2009 or earlier and these years were excluded as described in the Methods. On average, raw scores on the SAE-R improved by 5.5 questions from PGY3 to PGY4, which was statistically significant by paired sample t tests ($P < .0001$). The increase in raw score from PGY3 to PGY4 endorses the objective of the SAE-R as a measure of knowledge because one would

Table 1
SAE-R and part 1 examination scores

	N	Mean Score	Standard Deviation	Minimum	Maximum
PGY 3 SAE-R	1291	90.5	12.9	51	125
PGY 4 SAE-R	1612	96.0	13.0	46	135
Part 1 examination	1640	516	72	231	768

SAE-R = Self-Assessment Examination for Residents; PGY3 = third postgraduate year; PGY 4 = fourth postgraduate year.

expect medical knowledge to increase with progression of training.

Figures 1 and 2 illustrate the relationship of SAE-R raw scores and part 1 ABPMR-CE scaled scores. The intercepts and coefficients listed in Table 2 are the constants in the regression equation that would slice through the data points on the scatterplots. The R² value indicates the amount of variance in the dependent variable accounted for by the independent variable. SAE-R scores for PGY 3 candidates accounted for 24.8% of the variance in part I ABPMR-CE scores. For PGY 4 candidates, SAE-R scores accounted for 27.1% of the variance in part I ABPMR-CE scores. As residents proceed in training, scores on the SAE-R become better predictors of part 1 ABPMR-CE scores. Both coefficients were significant ($P < .0001$).

Figure 3 illustrates the part 1 passing rate for 10-point increments of SAE-R raw scores by PGY year. As noted in Table 1, there were no PGY3 scores greater than 125. SAE-R scores less than 60 (40% correct) for either year were associated with a low likelihood of passing the part 1 ABPMR-CE. SAE-R scores greater than 80 (53% correct) were associated with an 80% or greater chance of passing the ABPMR-CE. Scores greater than 90 (60% correct) on the SAE-R were associated with a 95% chance of passing the ABPMR-CE. Residents who

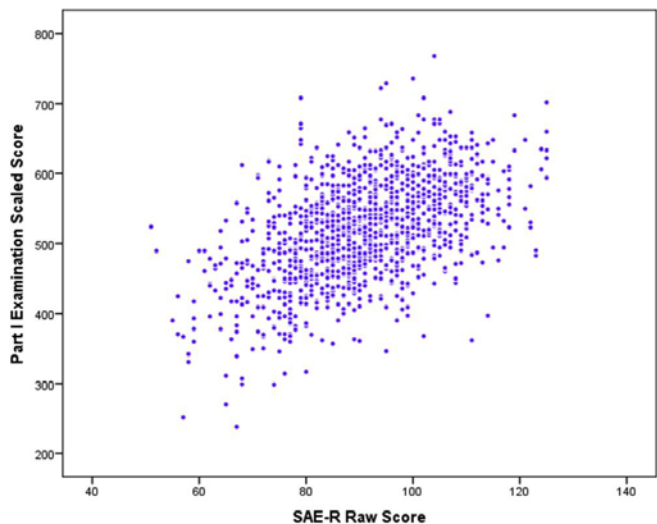


Figure 1. Scatterplot of third postgraduate year resident Self-Assessment Examination for Residents (SAE-R) raw scores and part 1 examination scaled scores.

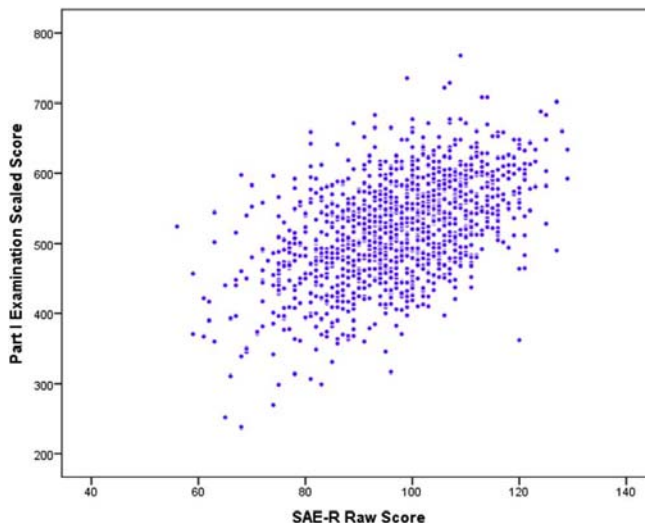


Figure 2. Scatterplot of fourth postgraduate year Resident Self-Assessment Examination for Residents (SAE-R) raw scores and part 1 examination scaled scores.

scored greater than the SAE-R mean for their year of training subsequently had very high passing rates on the part 1 ABPMR-CE.

Discussion

Individual residents and residency programs both have strong incentives to having graduates pass the part 1 ABPMR-CE on the first attempt. To become board certified in PMR by the ABPMR, a physician must pass both the part 1 (computer-based) and part 2 (oral) examinations. Failing to pass part 1 ABPMR-CE delays the opportunity to take part 2 and, ultimately, board certification. At the residency program level, a low first-time pass rate can negatively impact accreditation by the Accreditation Council of Graduate Medical Education and can compromise the program’s ability to attract competitive applicants. Identifying a resident at risk of failing the part 1 ABPMR-CE well in advance of the exam allows both the resident and the program to put a remediation plan in place. The AAPM&R SAE-R is the only objective assessment providing PMR residents with a national percentile ranking based on performance of residents corresponding to their year of training.

Table 2
Regression models in predicting part 1 examination scores from SAE-R raw scores

	Intercept	Unstandardized Coefficient	Standardized Coefficient	R ²
PGY 3 SAE-R	266	2.78	.50	.248
PGY 4 SAE-R	241	2.87	.52	.271

SAE-R = Self-Assessment Examination for Residents; PGY3 = third postgraduate year; PGY 4 = fourth postgraduate year.

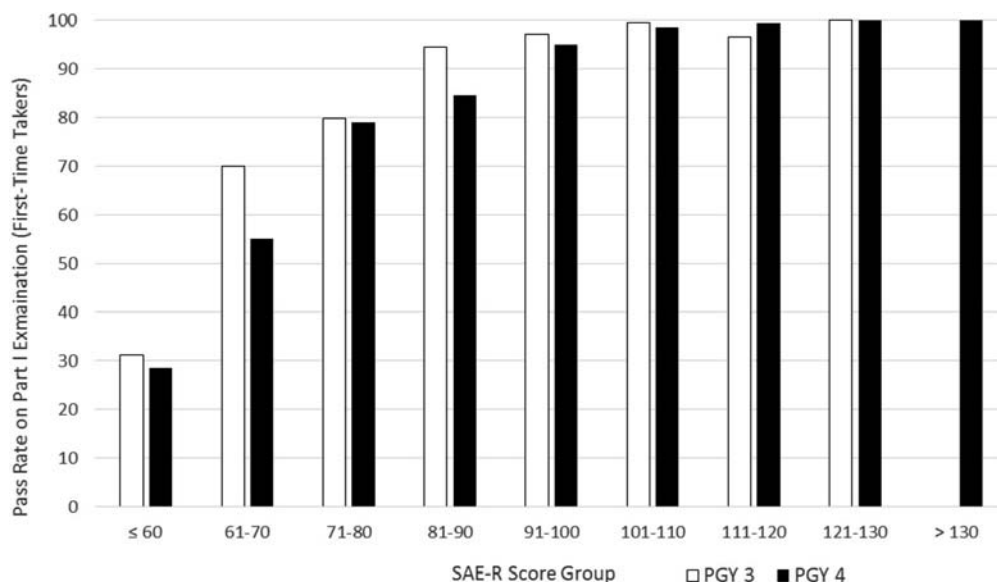


Figure 3. Pass rates on the part 1 examination by Self-Assessment Examination for Residents (SAE-R) score group. PGY3 = third postgraduate year; PGY 4 = fourth postgraduate year.

This study is the first published study of a large national cohort examining the relationship between the SAE-R and the ABPMR-CE. The results suggest that the SAE-R has utility in residents' self-assessment of their knowledge and of determining the likelihood of passing the part 1 ABPMR-CE. Average scores improve between the PGY 3 and PGY4 years, so residents can benchmark themselves to see whether they are improving as expected. Success on the ABPMR-CE was associated with performance on the SAE-R. Although the correlation is significant, performance on the SAE-R is only one contributor to explaining likelihood of passing part 1 ABPMR-CE. The SAE-R scores accounted for 24.8% and 27.1% of the variance in part 1 ABPMR-CE scores. Inherent differences in the examinations and degree of preparation for the examinations are likely contributors to the lack of a perfect correlation. The blueprints of the exams differ.

There are several limitations to this study. First, some residents may approach the SAE-R with little preparation, to gauge knowledge attained to date, whereas others may intentionally prepare for the exam. Thus, those who prepared little for the SAE-R may not be able to use the results in the same way as those who prepared more. It is also probable that residents who scored poorly on the SAE-R took the opportunity to prepare more diligently for the part 1 ABPMR-CE. Although we believe that a remediation plan may be helpful for those who have low SAE-R scores, we don't know how effective such intervention can be in increasing the chances of passing the ABPMR-CE. Future research could explore how residents prepare for the SAE or how they use results to guide preparation for the part 1 ABPMR-CE. For instance, researchers might prospectively collect self-reported data regarding how

many hours residents study preparing for the SAE-R to see whether the degree of preparation influences the predictive value of the SAE-R.

Conclusion

SAE-R scores during the PGY3 and PGY4 years of PMR residency training are significantly correlated with first-time performance on the part 1 ABPMR-CE. The SAE-R results should be useful to residents preparing for the part 1 ABPMR-CE and to program directors advising residents with low scores.

References

1. Althouse LA, McGuinness GA. The in-training examination: An analysis of its predictive value on performance on the general pediatrics certification examination. *J Pediatr* 2008;153:425-428.
2. Bedno SA, Soltis MA, Mancuso JD, Burnett DG, Mallon TM. The in-service examination score as a predictor of success on the American Board of Preventive Medicine certification examination. *Am J Prev Med* 2011;41:641-644.
3. Replogle WH, Johnson WD. Assessing the predictive value of the American Board of Family Practice In-training Examination. *Fam Med* 2004;36:185-188.
4. Johnson GA, Bloom JN, Szczotka-Flynn L, Zauner D, Tomsak RL. A comparative study of resident performance on standardized training examinations and the american board of ophthalmology written examination. *Ophthalmology* 2010;117:2435-2439.
5. Rinder HM, Grimes MM, Wagner J, Bennett BD. Senior pathology resident in-service examination scores correlate with outcomes of the American Board of Pathology certifying examinations. *Am J Clin Pathol* 2011;136:499-506.
6. Juel VC, Johnston KC. Predict Resident Exam Performance (PREP) Study. *Neurology* 2003;60:1385-1387.
7. Kim PY, Wallace DA, Allbritton DW, Altose MD. Predictors of success on the written anesthesiology board certification examination. *Int J Med Educ* 2012;3:225-235.

8. Hacker H, Micklesen P, King J, Robinson L. Association Between the EMG Self-Assessment Examination and. *Am J Phys Med Rehabil* 2008;87:221-223.
9. Dyrstad BW, Pope D, Milbrandt JC, Beck RT, Weinhoeft AL, Idusuyi OB. Predictive measures of a resident's performance on written Orthopaedic Board scores. *Iowa Orthop J* 2011;31: 238-243.
10. Babbott SF, Beasley BW, Hinchey KT, Blotzer JW, Holmboe ES. The predictive validity of the internal medicine in-training examination. *Am J Med* 2007;120:735-740.
11. Fish DE, Radfar-Baublitz L, Choi H, Felsenthal G. Correlation of standardized testing results with success on the 2001 American Board of Physical Medicine and Rehabilitation Part 1 Board Certificate Examination. *Am J Phys Med Rehabil* 2003;82:686-691.

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