5-1-2004

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Passing the Boards: Can USMLE and Orthopaedic In-Training Examination Scores Predict Passage of the ABOS Part-I Examination?

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Passing the written and oral examinations is a requirement for certification for the American Board of Orthopaedic Surgery (ABOS). Residents and residency program directors alike consider passing "The Boards" to be a priority. Part I of the ABOS examination consists of over 300 multiple-choice questions designed to test the candidate's knowledge in general orthopaedics, basic science, and the application of this knowledge. Part II is an oral examination administered to evaluate the candidate's competence in areas such as data gathering and interpretation, diagnosis, treatment, and technical skills. Passing the ABOS Part-I examination the first time is crucial to avoid delays in taking Part II and attaining board certification. In 2002, 553 (89%) of 623 first-time test-takers passed the ABOS Part-I examination. If one were to include repeat examinees, 637 (79%) of 805 passed[1]. The passing rate after one or more failures is dramatically lower than that for first-time examinees. In 2002, there were 182 repeat test-takers, of whom ninety-eight failed (a 54% failure rate), demonstrating the importance of passing the first time[1]. This suggests that inadequate training and preparation of an orthopaedic knowledge base for this examination during residency may be difficult to correct after an initial failure of the ABOS Part-I examination.

The ABOS Part-I examination represents one standardized test in a long battery of examinations already taken by graduating residents, which include the Standardized Admission Test; Medical College Admission Test; United States Medical Licensing Examination (USMLE) Steps I, II, and III; and Orthopaedic In-Training Examination (OITE) administered during postgraduate-years (PGY)-1, 2, 3, 4, and 5. Since orthopaedic residency applications are extremely competitive (in 2000, there were 1116 candidates for 554 positions), it can be inferred that orthopaedic residents have generally performed well on these previous examinations[2]. Indeed, it may be the unofficial policy of some residency programs to interview only applicants with USMLE Step-I scores above an established cutoff unless the applicant is already known to the department faculty. Nevertheless, every year more than 10% of postresidency orthopaedic surgeons fail the ABOS Part-I examination and fail to attain "Board-Eligible" status, which is defined as candidates who have successfully passed Part I and are waiting to take Part II[1].

In addition, performance on the ABOS Part-I examination is important for the residency program itself. For example, one of the few quantitative guidelines that the Orthopaedic Residency Review Committee (RRC) uses in its review of accredited residency programs is whether 75% or more of the graduates of a residency program pass the Part-I Examination on their first try[3]. Furthermore, performance of past residents on this test is regarded by residency directors and applicants as an important indicator of the quality of a residency's educational program. A program's consistently poor performance may be spread by word of mouth by potential applicants. For these reasons, programs with high failure rates may have greater difficulty attracting their top candidates.

Passage of the ABOS examination is important not only to residency programs but also to individual surgeons. While the board-certification process is strictly voluntary for the orthopaedic surgeon, some hospitals require it for hospital privileges and many practices require it for partnership. In addition, patients may check web sites such as www.abos.org or www.abms.org to see whether a physician is "Board Certified."

Although the annual OITE and the ABOS Part-I examinations both test orthopaedic knowledge, differences in psychometrics between the two tests may limit the ability of the score on the OITE to predict performance on the ABOS examination. Specifically, questions for the OITE are submitted by a group of orthopaedic surgeons from different subspecialties and are used in proper balance by the examination committee to comprise the examination. In comparison, the ABOS Part-I examination is composed of questions that were previously administered to board-certified orthopaedic surgeons, analyzed statistically, and selected for inclusion on the basis of their psychometrics.

TABLE I Relationship Between Scores on Previous Standardized Tests and ABOS Part-I Scores*

ABOS Part-I Percentile Score in Relation to Previous Test Results	Correlation Coefficient (R Value)	P Value	95% Confidence Interval
USMLE Step score	0.38	0.0022	0.14 to 0.57
OITE PGY-3 percentile	0.52	<0.0001	0.31 to 0.68
OITE PGY-4 percentile	0.49	<0.0001	0.28 to 0.66
OITE PGY-5 percentile	0.69	<0.0001	0.53 to 0.80

*ABOS = American Board of Orthopaedic Surgery, USMLE = United States Medical Licensing Examination, OITE = Orthopaedic In-Training Examination, and PGY = postgraduate year.

Given the importance of passing the ABOS Part-I examination, we sought to review ten years of orthopaedic resident standardized test data at our institution in order to search for a correlation between scores on previous standardized tests and performance on the ABOS written examination. We specifically chose the USMLE Step-I examination as a score for correlation with passage of the ABOS Part-I examination, since it is the most recent competitive test taken by the orthopaedic applicant. We tested the hypothesis that performing above a specific threshold score on this examination would correlate with a high likelihood of passing the ABOS Part-I examination. In addition, we also reviewed the OITE scores of the same cohort during the third, fourth, and fifth years in training to see whether scoring below a certain level on this test might represent a warning sign of possible failure on the ABOS Part-I examination.

The scores of all graduates of our residency program over a ten-year period for whom USMLE Step-I, OITE, and first-attempt ABOS Part-I scores were available were included in the data analysis. During the study period, the National Board of Medical Examiners (NBME) test was changed and renamed the USMLE examination. Therefore, it was necessary to convert the NBME scores into USMLE scores for statistical evaluation. According to the National Board of Medical Examiners, NBME scores (mean [and standard deviation] 500 ± 100) can be transformed into USMLE scores (mean, 200 ± 20) by a simple linear equation: USMLE = 200 + ([NBME-500]/5)[4]. For example, a score of 600 on the NBME is equivalent to 220 on the USMLE. Also, like most standardized tests, the scaling of the NBME Part-I scores changed from year to year on the basis of the population's performance. In addition, shorter tests were administered starting in 1999, causing standard deviations to increase. Accepting these limitations, the NBME score conversion was used for all statistical analysis.

Correlation coefficients between the ABOS Part-I percentiles and the USMLE Step-I and OITE scores for PGY-3, 4, and 5 were calculated with use of MedCalc (version 7.2.0.2; MedCalc Software, Mariakerke, Belgium). The strength of any significant correlation was graded as low ($0.1 < r < 0.39$), medium ($0.40 < r < 0.7$), or high ($0.70 < r < 1.0$)[5]. For this analysis, CART (categorical and regression tree) data-mining software (version 5.0; Salford Systems, San Diego, California), which can isolate patterns and relationships among data, was used to evaluate the raw data. The CART method categorizes and tabulates outcome (pass or fail) for every possible cutoff of a numerical variable, and it chooses from among the cutoffs the value that minimizes false classifications. Relative risks and 95% confidence intervals were calculated with use of SAS software (version 8.2; SAS Institute, Cary, North Carolina).

During the study period, sixty-five residents graduated from the program and sixty-four of them who met the inclusion criteria provided the study population. Throughout this period, the OITE was consistently proctored by a faculty member within our department. There was a 6.5-hour time limit imposed by the American Academy of Orthopaedic Surgeons (AAOS). No disciplinary actions were taken against residents receiving low scores, although the results for all of the residents were discussed with the Residency Program Director, and residents with low scores were encouraged to study and improve their scores. Among this group of sixty-four graduates, fifty-eight residents (91%) passed and six residents (9%)

TABLE II OITE Prognosticators for a Failing Score on the ABOS Part-I Examination*

Failure Rate†	OITE Scores Associated with Failure
63% (5/8)	PGY-3 score of <29th percentile and PGY-5 score of <20th percentile
43% (6/14)‡	PGY-3 score of ≤32nd percentile and PGY-4 score of <27th percentile

*OITE = Orthopaedic In-Training Examination, ABOS = American Board of Orthopaedic Surgery, and PGY = postgraduate year. †The values in parentheses indicate the number of residents with low scores who failed divided by the total number with low scores. ‡All failures occurred within this group.

failed the ABOS Part-I examination. The mean USMLE Step-I score (and standard deviation) was 211 ± 17.3 (range, 172 to 243). For the Orthopaedic In-Training Examination, the mean PGY-3 percentile was 45.4 ± 26.4 (range, 6 to 98), the mean PGY-4 percentile was 44.5 ± 27.2 (range, 4 to 98), and the mean PGY-5 percentile was 43.2 ± 27.1 (range, 3 to 99).

Correlation coefficients (r) were calculated (Table I) in order to determine relationships between the ABOS Part-I percentile scores and the USMLE and OITE percentile scores. The correlation coefficient for the USMLE Step-I score and the ABOS Part-I percentile score was 0.38 ($p = 0.002$). Correlation coefficients were also calculated for the OITE percentile scores for years 3 ($r = 0.52$, $p < 0.0001$), 4 ($r = 0.49$, $p < 0.0001$), and 5 ($r = 0.69$, $p < 0.0001$).

We used the CART software to identify any trends or relationships between these data. We identified a USMLE Step-I score of 204 as a critical number. Below this score, there was a 16% chance of failure (three of nineteen) on the ABOS Part-I examination. With a score of 204 or higher, there was a 7% chance of failure (three of forty-five) and therefore a 93% chance of passing (forty-two of forty-five). Consequently, the relative risk of failing the ABOS Part-I examination for students with USMLE Step-I scores below 204 was 2.63 (95% confidence interval, 0.48 to 14.38) times that of students scoring above 204.

When analyzing the OITE data with use of the CART software, several relationships became apparent. There was a high risk of failure (63%; five of eight failed) on the ABOS Part-I examination when a resident scored below the twenty-ninth percentile for PGY-3 and below the twentieth percentile for PGY-5. These so-called low-scoring residents had a relative risk of failure that was 91.7 (95% confidence interval, 8.0 to 1053) times that of the other residents. All failures occurred among those who scored below the thirty-second percentile for PGY-3 and below the twenty-seventh percentile for PGY-4 (Table II). No failures occurred (fifty passed) when either the PGY-3 score was above the thirty-second percentile or the PGY-4 score was above the twenty-seventh percentile (Table III).

TABLE III OITE Prognosticators for a Passing Score on the ABOS Part-I Examination*

Failure Rate†	OITE Scores Associated with Passage
0% (0/50)	PGY-3 score of >32nd percentile OR PGY-4 score of >27th percentile
2% (1/56)	PGY-3 score of >29th percentile OR PGY-5 score of >20th percentile

*OITE = Orthopaedic In-Training Examination, ABOS = American Board of Orthopaedic Surgery, and PGY = postgraduate year. †The values in parentheses indicate the number of residents who failed divided by the total number in that group.

We hypothesized that individuals who score better on standardized tests in the past should continue to do so throughout their training. However, the findings for the USMLE Step-I scores only weakly support our hypothesis. The correlation coefficient for the USMLE Step-I and ABOS Part-I scores was 0.38, a low-to-moderate correlation, although significant. However, poor performance on the OITE was a much stronger predictor of failure on the ABOS Part I. This would be expected since the examination is more recently taken (within three years of the ABOS compared with at least seven years for the USMLE Step I) and because both the OITE and ABOS examinations test orthopaedic knowledge.

Our data suggest that the USMLE Step-I score is not a strong predictor of individuals at increased risk for failing the Boards. Stated another way, the difference between a 16% potential ABOS failure rate (a USMLE score of <204) and a 7% potential ABOS failure rate (a USMLE score of >204) may not be large enough to deny a residency spot to an otherwise well-qualified applicant. There may have been extenuating circumstances (passing of a loved one, divorce, etc.) that precluded ideal performance on the USMLE Step-I examination. Alternatively, these individuals may have been less stimulated to learn basic medical science data, leading to a poorer performance on the earlier examination, whereas an interest in orthopaedics may motivate them to study more intensively in their field of interest. We chose not to include USMLE Steps II and III, since many of the candidates who take these examinations are already accepted into residency programs and there is less pressure to do well on these examinations.

The stronger message from our data is the importance of tracking OITE performance. In our cohort, all failures occurred among residents scoring below the thirty-second percentile during PGY-3 and below the twenty-seventh percentile during PGY-4. Obviously, each residency program is likely to have its own unique thresholds for poor OITE performance predictive of failure on the ABOS Part I. Program directors, and especially residents, should be aware that individuals are at risk for failure on the ABOS Part-I examination with performance below these levels, and they should devote additional time and energy to preparation for the PGY-5 OITE and ultimately the ABOS examination.

In summary, this analysis demonstrates that achievement on the USMLE Step-I examination does not guarantee passage of the ABOS Part-I examination. In our program, the USMLE scores of residents who failed the ABOS Part-I examination were as high as 231. However, the present study supports close tracking of OITE performance by residency program directors. Residents who scored in the lowest third on the OITE in PGY-3 and 4 stood a much greater chance of failing the ABOS Part I, and we believe that residents who consistently score below the thirtieth percentile on the OITE should receive focused attention by the residency program faculty. It must be stated,

however, that it is ultimately the responsibility of each resident to learn the fundamentals of orthopaedic surgery and to adequately prepare for these examinations.

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The authors did not receive grants or outside funding in support of their research or preparation of this manuscript. They did not receive payments or other benefits or a commitment or agreement to provide such benefits from a commercial entity. No commercial entity paid or directed, or agreed to pay or direct, any benefits to any research fund, foundation, educational institution, or other charitable or nonprofit organization with which the authors are affiliated or associated.

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