Aggregate Interview Method of Ranking Orthopedic Applicants Predicts Future Performance

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abstract

This article evaluates and describes a process of ranking orthopedic applicants using what the authors term the Aggregate Interview Method. The authors hypothesized that higher-ranking applicants using this method at their institution would perform better than those ranked lower using multiple measures of resident performance.

A retrospective review of 115 orthopedic residents was performed at the authors’ institution. Residents were grouped into 3 categories by matching rank numbers: 1-5, 6-14, and 15 or higher. Each rank group was compared with resident performance as measured by faculty evaluations, the Orthopaedic In-Training Examination (OITE), and American Board of Orthopaedic Surgery (ABOS) test results. Residents ranked 1-5 scored significantly better on patient care, behavior, and overall competence by faculty evaluation ($P < .05$). Residents ranked 1-5 scored higher on the OITE compared with those ranked 6-14 during postgraduate years 2 and 3 ($P < .5$). Graduates who had been ranked 1-5 had a 100% pass rate on the ABOS part 1 examination on the first attempt. The most favorably ranked residents performed at or above the level of other residents in the program; they did not score inferiorly on any measure.

These results support the authors’ method of ranking residents. The rigorous Aggregate Interview Method for ranking applicants consistently identified orthopedic resident candidates who scored highly on the Accreditation Council for Graduate Medical Education resident core competencies as measured by faculty evaluations, performed above the national average on the OITE, and passed the ABOS part 1 examination at rates exceeding the national average.

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Orthopedic residency programs invest considerable time and effort assessing applicants each year to submit a rank list to the National Residency Matching Program, hoping to match the best-qualified candidates and train the most promising orthopedic surgeons. What criteria should be used to generate this rank list, which will determine who will be future orthopedists? Little consensus exists about which factors or what process, if any, can effectively predict future resident performance. Scores on the United States Medical Licensing Examination (USMLE), selection to Alpha Omega Alpha national medical honor society, class rank, honors grades in clerkships, letters of recommendation, publications, and research projects have all shown variable correlations with resident performance.1–6

Although many cognitive factors are used as screening tools for applicants, most programs rely on personal interviews for noncognitive traits, such as personality and work ethic, to determine resident potential. However, even focused interviews have not reliably shown a direct correlation in predicting future resident success.7–9 A selection process that consistently identifies the best candidates to become outstanding surgeons ensures the future of the specialty.

This article evaluates and describes a process of ranking applicants the authors term the Aggregate Interview Method. The cornerstones of this model include topic-focused interviews conducted by 2-person faculty teams and a personal rank list from each interviewer that is aggregated into a final rank list. The authors evaluated the ability of the Aggregate Interview Method to predict subsequent resident performance. The authors hypothesized that higher-ranking applicants using this method would perform better than those ranked lower using multiple measures of resident performance.

Materials and Methods

The University of Minnesota granted an institutional review board exemption for this study as a quality improvement project. A review was performed of all residents who matriculated in the University of Minnesota Orthopaedic Surgery Residency Program between 1994 and 2011. Electronic faculty evaluations, the Orthopaedic In-Training Examination (OITE), and the residents’ scores on the American Board of Orthopaedic Surgery (ABOS) parts 1 and 2 were the outcome measures used to assess resident performance. Data availability for each outcome measure depended on the year in training for each group of residents.

Aggregate Interview Method

The Aggregate Interview Method of ranking applicants has evolved into a consistent approach over the past 11 years. Applications are initially screened by 2 faculty members (A.V., T.G.) using several criteria, including USMLE scores, medical school grades and achievements, research experience, letters of recommendation, volunteer activities, and diversity of background. From this group of 400 to 500 applicants, approximately 50 applicants were selected for interviews to fill 8 positions. The applicants selected for interviews included an equal number of medical students that had satisfactorily completed a clerkship at the authors’ program and those who had no prior experience there.

One chief resident (J.G.) and 19 faculty members were paired for a total of 10 two-person interviewing teams. Interviewers represented all 6 hospital sites in the residency program. Each applicant’s residency application was provided to the interviewing faculty prior to the interview date for review.

All applicants interviewed with 5 of the 10 teams, meeting half the interviewing faculty. Therefore, each team ultimately interviewed half the applicants. An area of focus was assigned to each team to cover during the 25-minute interview, including work ethic and motivation, patient care and motor skills ability, career goals and suitability for the program, ethical behavior and professionalism, and academic performance.

Following the interviews, all interviewers participated in a round table discussion to review their experiences with the applicants. Each interviewer submitted a personal rank list from 1 to 25 for the applicants that he or she interviewed. All rankings were aggregated, and each applicant was represented by a mean rank and standard deviation that formulated the final rank list, including up to 50 ranked applicants. If applicants had the same mean rank, the applicant with the smaller standard deviation was ranked more favorably.

Analysis of Rank Position to Outcome Measures

The rank list position for each resident matriculated in the program was divided into 3 groups: 1-5 (top rank), 6-14, and 15 and higher (bottom rank). Rank list position was then compared with the resident’s performance using the faculty evaluations, OITE scores, and ABOS performance. Rank list position was also compared using the USMLE scores to determine whether USMLE was correlated to rank position.

Faculty Evaluations

Each faculty member on every rotation graded each resident on the 6 core Accreditation Council for Graduate Medical Education (ACGME) competencies, as well as technical skills and overall competence. This information was gathered electronically using E*Value (Advanced Informatics, Minneapolis, Minnesota), an online commercially available system. Each resident was given a score of 1 to 5, with 1 as the lowest score, 3 as commensurate with the level of training, and 5 as outstanding. Faculty evaluation using E*Value began in 2000 and all available data were used.
Orthopaedic In-Training Examination Scores

Orthopaedic In-Training Examination scores were recorded for each resident for postgraduate years 2 through 5 from the years 1994 through 2011. The percentile rank among their designated postgraduate year group for the total score of the examination was used for each resident.

American Board of Orthopaedic Surgery Results

The ABOS part 1 examination results were assessed by raw score and by the number of attempts required to pass. Because the scores were reported in percentiles during the years 1999 through 2004, the ABOS was contacted and provided the raw scores. For the ABOS part 2 examination results, only the number of passing attempts was analyzed because raw scores were not given.

Statistical Methods

The authors compared the outcome measures for residents ranked 1-5 with those ranked 6-14 and compared those ranked 1-5 with those ranked 15 and higher to elucidate any difference that might have been difficult to detect with the wider ranges. Mean E*Value, ABOS part 1, OITE, and USMLE scores were compared between the residents using Student’s t test or the Wilcoxon rank-sum test, depending on the normality of the data. The ABOS part 1 and 2 examination pass attempts were compared between the residents using Pearson’s chi-square test or Fisher’s exact test where indicated.

RESULTS

Between 1999 and 2011, a total of 131 residents matriculated to the program. Nine residents did not complete the program and had inadequate performance data for review; 7 residents matriculated outside the match system and thus had not been ranked. Twelve residents were at the first- and second-year orthopedic resident level and did not have sufficient performance data to allow analysis, resulting in 103 residents included in the study. Mean rank of the 103 residents included in this study was 9 (range, 1-26).

Resident performance data were available for electronic faculty evaluations for 103 residents and for OITE scores for 101 residents. The ABOS part 1 examination scores were available for 68 residents because scores were only available for graduated second-year orthopedic residents. The USMLE scores were also evaluated for 108 residents.

United States Medical Licensing Examination

Of the 108 residents with available USMLE data, 33 were ranked 1-5, seventy-five were ranked 6-14, and 22 were ranked 15 and higher. Applicants ranked 1-5 had a mean USMLE score of 230. Applicants ranked 6-14 and 15 and higher each had a mean score of 225. No statistical difference was found between these groups (P=.11 to .24), indicating that although the residents were screened using USMLE as 1 objective measure of cognitive ability, it was not a significant criteria for final rank.

Faculty Evaluations

Of the 103 residents with available faculty evaluations, 34 were ranked 1-5, sixty-nine were ranked 6-14, and 19 were ranked 15 and higher. All ranking groups were compared for each of the 8 different E*Value areas (Figure 1). Residents ranked in the top 5 rated higher in all areas of core competencies compared with those who were ranked 6-14 or 15 and higher (P<.001 to P=.18). This difference was statistically significant for patient care, behavior, and overall competence (P<.05).

Orthopaedic In-Training Examination

Of the 101 residents evaluated by the OITE, 35 were ranked 1-5, sixty-six were ranked 6-14, and 16 were ranked 15 and higher. Mean OITE scores for the different ranking groups were compared for each year residents took the examination. Residents ranked 1-5 scored higher on the OITE compared with those ranked 6-14 during postgraduate years 2 and 3 (P≤.014). No statistical differences were found in other OITE comparison groups, but residents ranked 1-5 had higher OITE scores.
scores for all years than residents ranked 6-14 (Figure 2).

American Board of Orthopaedic Surgery Results
Of the 69 ranked graduates who had taken the ABOS part 1 examination, 22 were ranked 1-5, forty-seven were ranked 6-14, and 10 were ranked 15 and higher. Of the 47 ranked graduates who had taken ABOS part 2 examination, 16 were ranked 1-5, thirty-one were ranked 6-14, and 7 were ranked 15 and higher. Graduates ranked 1-5 had a 100% pass rate of the part 1 examination on the first attempt; those ranked 6-14 had a pass rate of 89% on the first attempt ($P=.17$). The first attempt pass rate of the ABOS part 1 examination for the authors’ program was 93% overall. No difference was found between groups for passing the ABOS part 2 examination on the first attempt, with an overall pass rate of 86% ($P=.68-.99$).

Discussion
Several methods are used to rank applicants with the goal of obtaining the best residents for any training program. The orthopedic department at the authors’ institution strives to select applicants who will perform well as residents and subsequently become competent, board-certified orthopedic surgeons. Currently, no consensus exists on the best method for generating a rank list that will achieve this goal. The current study evaluated the Aggregate Interview Method of ranking residents based on 3 resident performance measures: faculty evaluations and the OITE and ABOS examinations.

The authors’ program recorded each faculty’s evaluation of resident performance on each rotation on the 6 ACGME core competencies, as well as technical ability and overall competence. Residents ranked 1-5 were rated higher in all areas of core competencies compared with those who were ranked 6-14 or 15 and higher ($P<.001$ to $P=.18$). This difference was statistically significant for patient care, behavior, and overall competence ($P<.05$). With 8 rotations per year and approximately 80 faculty educators for each resident, a resident’s performance is accurately reflected, with outliers given little weight.

In the authors’ program, the top 5 ranked residents scored statistically higher on the OITE early in training (postgraduate years 2 and 3), but no difference was found in later years. Although no statistical difference was found between rank and ABOS pass attempts, 100% of residents who were ranked 1-5 passed the ABOS part 1 examination on the first attempt. The overall first attempt pass rate of ABOS part 1 examination is 93% in the authors’ program, which is higher than the national average range of 79% to 88% in recent years.$^{10}$ Several studies have found that OITE score does not correlate with faculty evaluation of resident performance.$^{2,3}$ Nonetheless, the current authors consider it an important outcome measure because the OITE score has been shown to correlate with the ABOS part 1 examination pass rate, and passing this examination is required to become a board-certified orthopedic surgeon, a primary goal for all orthopedic residents.$^{11-13}$ However, it remains unclear whether such standardized examination scores translate to superior physician skills and an ability to care for patients.

The USMLE scores of the applicants did not correlate with rank. The USMLE score was used in the interview selection only as a threshold to determine who would be chosen for interviews because it is predictive of an ability to satisfactorily complete standardized examinations, such as the OITE and ABOS part 1 examination.$^{11,12,14}$ Thus, it did not correlate with performance. The Aggregate Interview Method relies on the interviewer’s assessment of personality characteristics and other nonobjective measures that can be best appreciated during face-to-face contact as the most important factor in creating the rank list. Prior studies have shown that USMLE scores did not correlate well with future resident performance evaluated by faculty.$^{3,4,15,16}$ The current study corroborates those findings and discourages the exclusive use of objective data in ranking residents, giving additional merit to the authors’ method.

To the authors’ knowledge, only 2 studies in the orthopedic literature have
evaluated the match rank list and subsequent performance as residents. Dirschl et al reported that the residents the faculty rated in the top 15% had a mean rank of 8 and those the faculty rated in the bottom 15% had a mean rank of 20. In a study by Thordarson et al, residents were re-ranked on completion of residency by the same faculty, and no correlation was shown to their preresidency rank match list. The current authors believe that the Aggregate Interview Method is a more rigorous approach with the use of multiple outcome measures, including prospectively gathered faculty evaluations by each faculty member for each resident during every rotation.

Two studies in the literature exploring resident outcome use a method of ranking residents similar to the current method, but do so in other specialties. In both studies, a preliminary rank list is independently generated by faculty based on the resident’s application and interview. The final rank list is then developed from either a sum or a mean score for each candidate, which is then discussed, adjusted, and approved by a group. In their general surgery program, Brothers and Wetherholt found that the USMLE correlated with American Board of Surgery scores but not with the E*Value faculty evaluation. In radiology, Adusumilli et al found that rank did not correlate with faculty evaluation or results of the American Board of Radiology written examination.

The current study has several limitations. To the authors’ knowledge, no studies validate the E*Value format or the OITE or ABOS examinations as outcome instruments for the purpose used here. The current study was performed at a single residency program; additional data from other programs that use such an approach would be advantageous. Strengths of this study include the multiple measures evaluated, the length of the study, and the number of residents evaluated. The pool of applicants for orthopaedic residency tends to be homogenous, reflected in the tight spread of applicant rank, and the current study may be biased to some extent by a halo effect. Similarly, faculty members who interview applicants and are aware of the resident’s rank position may be favorably disposed to rate the resident highly during evaluations. However, the E*Value system collects evaluations from approximately 80 faculty, not just the 20 involved in the interview process.

**CONCLUSION**

This is the first study in the orthopedic literature describing a ranking method that identifies applicants who perform well as residents using prospectively gathered faculty evaluation, OITE scores, and ABOS examination pass rates over a period of more than 10 years. These results support the authors’ method of ranking residents using the Aggregate Interview Method, which consistently identified orthopaedic resident candidates who will score highly on ACGME resident core competencies as measured by E*Value faculty evaluations, perform above the national average on the OITE, and pass the ABOS part I examination at rates exceeding the national average. Some evolution of this method is expected because the authors strive to improve the method’s ability to predict performance and plan to periodically reevaluate the method for this purpose.

**REFERENCES**