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SELECTION OF ENDOCRINOLOGY SUBSPECIALTY TRAINEES: WHICH APPLICANT CHARACTERISTICS ARE ASSOCIATED WITH PERFORMANCE DURING FELLOWSHIP TRAINING?

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Abstract

Objective—To determine which residency characteristics are associated with performance during endocrinology fellowship training as measured by competency-based faculty evaluation scores and faculty global ratings of trainee performance.

Method—We performed a retrospective review of interview applications from endocrinology fellows who graduated from a single academic institution between 2006 and 2013. Performance measures included competency-based faculty evaluation scores and faculty global ratings. The association between applicant characteristics and measures of performance during fellowship was examined by linear regression.

Results—The presence of a laudatory comparative statement in the residency program director's letter of recommendation (LoR) or experience as a chief resident was significantly associated with competency-based faculty evaluation scores ($\beta = 0.22$, $P = 0.001$; and $\beta = 0.24$, $P = 0.009$, respectively) and faculty global ratings ($\beta = 0.85$, $P = 0.006$; and $\beta = 0.96$, $P = 0.015$, respectively).

Conclusion—The presence of a laudatory comparative statement in the residency program director's LoR or experience as a chief resident were significantly associated with overall

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performance during subspecialty fellowship training. Future studies are needed in other cohorts to determine the broader implications of these findings in the application and selection process.

Keywords

selection criteria; fellowship; performance

Introduction

Endocrinology fellowship training program directors and selection committees invest considerable time and effort attempting to identify the best applicants for admission to their training program. During the selection process, the suitability of an applicant is typically judged based on review of a combination of data that may include objective data, such as grades or United States Medical Licensing Examination (USMLE) test scores, and subjective characteristics from personal statements, letters of recommendation, and performance during individual interviews. Other factors such as research experience, honors and awards and extracurricular activities are often subjectively considered as well. There is no consensus on a standard formula to judge or weigh applicant data/characteristics during the selection process.

To our knowledge, studies investigating the correlation between interview selection criteria and performance in subspecialty internal medicine training programs, including those in endocrinology, have not been previously published. Most of the available literature regarding the relationship between interview selection criteria and subsequent performance in medical training comes from residency programs. A literature review of correlation studies investigating the relationship between medical student performance and subsequent residency performance reported overall inconsistent results for most performance measures.^[1] The authors of this study noted that clinical performance, USMLE step I and II scores, and honor society membership appeared to correlate most strongly with performance on examinations in residency, whereas clerkship grades, faculty interview and reputation of medical school attended appeared to correlate most strongly with residency supervisor ratings. A subsequent meta-analysis reported that USMLE step I and 2 scores and residency in-training examinations showed the strongest positive association,^[2] whereas moderate positive associations were present for medical school grade point average and USMLE step I and II scores and faculty evaluation reports. Minimal or no associations, however, were found for interviews, reference letters and Deans' letters.

Predictive studies of selection criteria and performance specific to internal medicine-related residency programs are limited and show inconsistent results. Fine and colleagues found significant association between internal medicine residents' final overall evaluation scores submitted to the American Board of Internal Medicine (ABIM) and internal medicine clerkship honors and graduation from the residency's own medical school.^[3] Others have reported correlation of rank status in an internal medicine and family residency program with objective structured clinical examination scores, clerkship grade in internal medicine and final grade in medical school.^[4] A later study identified that the quality of medical school and the applicant's medical school performance evaluation were predictive of

subsequent subjective overall performance, and used this finding to design an algorithm to rank applicants at interview time.^[5] Cullen and colleagues found that the strength of comparative statements in letters of recommendation for internal medicine residency applicants was associated with multisource professionalism ratings during internship, while other variables traditionally examined when selecting residents were not associated with professionalism ratings.^[6]

The predictive value of resident applicant data/characteristics to performance in subspecialty fellowship training programs has not been previously studied. The objective of this study was to determine if associations exist between resident applicant characteristics and subsequent performance measures obtained during endocrinology fellowship. Primary performance measures included (1) end-of-training ACGME competency-based faculty evaluation scores and (2) end-of-training faculty global ratings of trainee performance. Secondary performance measures included (1) didactic conference attendance, (2) number of peer-reviewed publications, and (3) performance on the ABIM subspecialty certification examination in endocrinology.

Methods

Participants

We performed a retrospective cohort analysis of all trainees who entered and graduated from the clinical endocrinology fellowship training program at Mayo School of Graduate Medical Education between July 2006 and July 2013. Data was abstracted by the primary author and current education program coordinator from application files and the institution's electronic evaluation system. The study was approved by the Institutional Review Board of the Mayo Clinic.

Applicant Predictor Variables

Laudatory comparative statements on the candidate's internal program director's LoR (defined as any statement that indicated a resident was considered to perform at a higher level than his/her peers), or experience as chief resident were categorized as a variable present or absent. Due to the skewed nature of the data, the number of peer-reviewed publications (verified using Medline search of authors) was converted to dichotomous categorical variables of 0 or ≥ 1 peer reviewed publication. Three-digit USMLE Step I, II and III scores, and the size of the internal medicine residency program (the number of all types of internal medicine residents in that program) were analyzed as both continuous variables and also converted to dichotomous variables at or above the median and below the median.

Performance Outcome Variables

We used two primary outcome measures for performance during fellowship: (1) end of-training ACGME competency-based faculty evaluation scores (5-point Likert scale) herein termed faculty evaluation scores, using an institution-developed electronic evaluation system and, (2) end-of-training global faculty ratings (herein termed faculty global ratings)

completed by 4 key clinical faculty (who had experience working with all trainees in the cohort analysis) using the following modified scale^[7]:

- 0 = incompetent – should not have graduated
- 1 = competent – met minimum expectations
- 2 = proficient – unquestionably capable but not distinguished among peers
- 3 = outstanding – sets the benchmark for other fellows in performance
- 4 = aspirational – on par with junior faculty

Secondary outcomes included: (1) number of peer-reviewed publications verified using Medline search of authors generated during or within one year of graduation; (2) percent attendance at didactic conferences and (3) percent correct score on the ABIM subspecialty certification examination in endocrinology.

Statistical Analysis

Linear regression analysis was used to examine the association between predictor variables and outcome variables. Significance was set at $p < 0.05$. Statistical analysis was performed using SAS version 9.3 (SAS Institute, Cary, NC).

Results

Of the 30 trainees (20 female, 10 male) who entered the program during the study period, 29 graduated between 2006 and 2013 (one trainee elected to leave the program after the first year; data not included in analysis). The size of applicants' internal medicine residency programs ranged from 30 to 177 residents (median 127). Five residents had experience as chief residents (17%), and 10 (34%) had LORs that contained a laudatory comparative statement. Of these, 3 letters indicated that the applicant was among the best residents worked with (without applying a percentage), and 7 letters indicated that the applicant was among the top 25% or higher group of performing residents worked with. Mean $\pm$ standard deviation 3-digit USMLE step I, II and III scores were 235 ± 19.93 , 231 ± 19.99 and 220 ± 11.57 , respectively. Mean $\pm$ standard deviations of the faculty evaluation scores and faculty global ratings were 4.03 ± 0.28 and 2.0 ± 0.9 , respectively. There was significant positive correlation between faculty evaluation scores and faculty global ratings ($R = 0.71$, $P = 0.001$). Interrater agreement for the faculty global ratings was excellent (mean intraclass correlation coefficient, 0.86). An analysis of trainees in the top 20% and bottom 20% of faculty global ratings showed that both groups of trainees were distributed evenly throughout the study interval (data not shown). Twenty three (79%) trainees published in peer reviewed journals during fellowship or within one year of graduation. ABIM subspecialty certification in endocrinology examination results were available in twenty three (79%) fellows with a mean percent correct score of 80.43 ± 5.04 , and a mean decile range of 7.96 ± 1.8 . There was no correlation between size of an applicant's internal medicine residency program and presence of a laudatory comparative statement in the LoR ($\beta = 1.68$, $P = 0.94$).

Two selection criteria, namely presence of a laudatory statement in the LoR and experience as a chief resident, were found to be positively associated with performance during

fellowship (Table 1). Analysis of secondary outcome measures showed that only the percent correct score on the ABIM certification in endocrinology was associated with USMLE III scores ($\beta = 0.18$, $P = 0.042$). No significant association was found between other predictor variables and secondary outcome variables (Table 2).

Discussion

In this study, presence of a laudatory comparative statement in the internal medicine program director's LoR and experience as a chief resident were positively associated with higher clinical performance in our endocrinology fellowship program, as measured by faculty evaluation scores and faculty global ratings. Several studies examining the association between LoR and subsequent performance in residency programs have also demonstrated a positive relationship,^[8–10] including an earlier study from our institution.^[6] In contrast to these positive studies, no association between LoR and subsequent performance has been reported in some surgical^[7, 11] and pediatric residency programs.^[12] The conflicting results from these studies are likely due to a number of factors, including substantial variability in content of LoR,^[13] different criteria used in grading LoR,^[1] and difficulty in reaching a consensus on what constitutes a good LoR.^[14] The shortcomings of the LoR have led some specialties including emergency medicine to create a standard letter of evaluation that might allow for meaningful comparisons to peers and a global perspective on an applicant's candidacy.^[15, 16] One study, however, reported that the global assessment score component of the standardized letter of recommendation correlated poorly with a candidate's rank order position in the residency match.^[17] Because of reported difficulty of grading the content of the LoR, we chose to simplify analysis of the LoR by only analyzing the presence of laudatory comparative statements, rather than a wide variety of exemplary statements and other qualitative factors. In addition, because only one third of letters contained a laudatory comparative statement, we were only able to analyze the data as a categorical variable (present or not) rather than rank the statements based on strength of positivity. Evaluation of internal medicine residents is challenging and complex. However, most evaluators can identify top performers in a global sense that is often reflected in a subjective laudatory statement in a letter of recommendation. Whatever this measures, it appears to be a durable character trait that carries over into fellowship performance, and may have implications to performance beyond fellowship, although that is beyond the scope of the current investigation.

Experience as a chief resident and subsequent performance during subspecialty training has not been previously studied. One might expect chief residents to exhibit superior performance in subsequent training programs as they are presumed to be chosen from the top group of residents in their class, and in most cases have the advantage of an additional year of training. However, a national survey of family medicine residency programs found that the preparation, selection, and responsibilities for the position of chief resident role vary widely.^[18] Thus performance during subspecialty fellowship of a former chief resident, as for other applicants, might be impacted by the overall effectiveness of their residency program. We do not have data on whether some of the fellows in our training program had been offered but declined a chief resident position.

Unlike previous studies conducted in residency programs which have indicated a mild to moderate correlation of standardized tests scores and various outcome measures, [1, 2, 19] we found no such association between USMLE I and II scores and performance measures in the endocrinology fellowship setting. A significant association was found between USMLE step III scores and performance on the ABIM subspecialty examination in endocrinology. The relevance of this finding is unclear. Interpretation is limited as ABIM scores were not available for all trainees and the pass rate in this cohort was 100%. To our knowledge, correlation of USMLE III scores with subsequent impact on performance during further training has not been studied previously.

Our study has several limitations. The study sample size is relatively small and from a single institution. In addition, the potential for sampling bias exists in that study subjects are already a highly selected group, and hence determining statistically significant differences within this cohort to predict performance is a challenge. The range of faculty evaluation scores was narrow and it is unknown whether higher scores corresponded to better performance. Furthermore, the electronic evaluation system used to track trainee performance is unique to our institution and over time there may have been variances in how faculty completed these evaluations. Finally, in 2013 changes were made to evaluation and reporting of trainee performance both in residency and fellowship programs due to requirements of ACGME's Next Accreditation System (e.g., reporting milestones). How this data and its interpretation might affect the process of selection of candidates for fellowship training is as yet unknown. Study strengths include stability of the major educational elements of the training program, presence of the same program director, and low turnover of both interview selection committee members and faculty involved in fellow performance evaluation throughout the duration of the study period. In addition, inclusion of faculty global rating scores by key educational faculty who are more engaged in education and hence may have a better sense and comfort of discriminating between performance levels might have provided more valid evaluation metrics.

In summary, we found that presence of a laudatory comparative statement in the residency program director's LoR and experience as a chief resident were significantly associated with higher performance as judged by overall evaluation scores during an endocrinology fellowship program. These findings extend the literature on the relationship between applicant characteristics and subsequent performance in advanced training programs. Further studies are needed to confirm these findings and identify other potential predictors of fellowship performance across a spectrum of subspecialty training.

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Abbreviations

ACGME	Accreditation Council of Graduate Medical Education
LoR	letters of recommendation
USMLE	United States Medical Licensing Examination
ABIM	American Board of Internal Medicine

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Table 1

Association Between Applicant Variables and Mean Competency Based Faculty Evaluation Scores and Mean Faculty Global Ratings at the end of Endocrinology Fellowship Training

Applicant variables (predictor)	No. (%) (N=29)	Competency-based evaluation score		Faculty global rating score	
		$\beta \pm SE$	P value	$\beta \pm SE$	P value
LoR					
Yes	10 (34)	0.22±0.06	0.01	0.85±0.29	0.006
No	19 (66)				
Chief residency					
Yes	5 (17)	0.24±0.09	0.009	0.96±0.37	0.015
No	24 (83)				
1 peer reviewed publication					
Yes	14 (48)	-0.06±0.07	0.460	-0.01 ±0.31	0.968
No	15 (52)				
Research experience					
Yes	23 (79)	-0.07±0.09	0.444	0.09±0.39	0.819
No	6 (11)				
Volunteerism					
Yes	20 (69)	0.02±0.08	0.848	0.45±0.33	0.182
No	9 (31)				
median USMLE I					
Yes	15 (52)	0.14±0.07	0.063	0.40±0.30	0.200
N	14 (48)				
median USMLE II					
Yes	15 (52)	0.07±0.07	0.364	-0.10±0.31	0.757
No	14 (48)				
median USMLE III					
Yes	16 (55)	-0.12±0.07	0.094	0.17±0.31	0.589
No	13 (45)				

Applicant variables (predictor)	No. (%) (N=29)	Competency-based evaluation score		Faculty global rating score	
		$\beta \pm SE$	P value	$\beta \pm SE$	P value
median size of internal medicine residency program					
Yes	15 (52)	0.10 $\pm$ 0.10	0.33	-0.3 $\pm$ 0.33	0.29
No	14 (48)				
	Mean $\pm$ SD	<i>r</i>			
USMLE step I score	235 $\pm$ 19.93	0.001 $\pm$ 0.001	0.494	0.003 $\pm$ 0.008	0.731
USMLE step II score	231 $\pm$ 19.99	0.003 $\pm$ 0.002	0.168	0.002 $\pm$ 0.008	0.854
USMLE step III score	220 $\pm$ 11.57	-0.003 $\pm$ 0.003	0.317	-0.02 $\pm$ 0.038	0.996

ABIM, American Board of Internal Medicine; LoR, internal medicine program director's letter of recommendation; USMLE, United States Medical Licensing Examination.

Table 2

Association Between Applicant Variables and Number of Peer Reviewed Publications, Conference Attendance, and Performance on the ABIM Examination in Endocrinology.

Applicant variables	^a ABIM Endocrinology % correct score	Conference attendance %	Number of peer reviewed publications
	$\beta \pm \text{SE}$		
LoR	-1.03±2.28	1.68±3.57	-1.45±1.02
Chief residency	0.92±2.91	7.01±4.31	-0.78±1.34
1 peer review publication	3.67±2.11	-2.35±3.38	1.03±0.98
Research experience	0.65±2.68	3.36±4.16	0.51±1.25
Volunteerism	-1.15±2.51	7.89±3.36	0.99±1.08
median USMLE I	-1.83±2.22	3.59±3.34	-1.3±0.97
median USMLE II	0.18±2.26	-0.14±3.41	-1.05±1.0
median USMLE III	4.03±2.07	-1.39±3.41	0.30±1.02
	r		
3-digit USMLE step I score	0.22	0.17	-0.12
3-digit USMLE step II score	0.06	0.15	-0.04
3-digit USMLE step III score	<i>b</i> _{0.43}	0.20	0.04
Size of Internal Medicine Residency Program (n)	-0.319	-0.09	0.09

^a data available on 23 (79%) subjects

^b *p* < 0.05

ABIM, American Board of Internal Medicine; LoR, internal medicine program director's letter of recommendation; USMLE, United States Medical Licensing Examination.