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Predictive Power of Resident Selection Criteria for Clinical Performance in General Surgery Residency

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Abstract : **To evaluate the ability of the resident selection criteria to predict clinical performance of general surgery residents, the application files and resident evaluations of 35 general surgery residents who were in the residency program of the Department of Surgery, Faculty of Medicine Siriraj Hospital during the 2000 - 2001 and 2001 - 2002 academic years were reviewed. A correlation study was done using scores from three selection criteria (medical school grades, letters of recommendation, and interview) as predictors and clinical performance ratings as outcomes. The interview scores were the best predictor for overall performance of residents in the first and second years. The GPA scores were the best predictor for overall third-year performance. Each selection criterion contributed unique predictive ability for resident performance. The combination of interview scores, scores from letters of recommendation, GPA scores, and ages at admission could predict 60.5% of the total variance in the overall first-year performance scores ($R = 0.778$, $p = 0.012$). The combination of interview scores and scores from letters of recommendation could predict 31.4% of the total variance in the overall performance scores in the second year ($R = 0.56$, $p = 0.049$). None of the multiple regression models demonstrated statistically significant prediction for the third-year overall performance.**

Key words : Resident selection, general surgery residents, clinical performance prediction, medical school grades, letters of recommendation, interview

เรื่องย่อ : การทำนายความสามารถทางคลินิกของแพทย์ประจำบ้านสาขาศัลยศาสตร์ทั่วไปด้วยผลการคัดเลือกแพทย์ประจำบ้าน

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ผลการคัดเลือกแพทย์ประจำบ้านและผลการประเมินการปฏิบัติงานของแพทย์ประจำบ้านสาขาศัลยศาสตร์ทั่วไป ภาควิชาศัลยศาสตร์ คณะแพทยศาสตร์ศิริราชพยาบาล ในช่วงปีการศึกษา 2543 - 2544 และ 2544 - 2545 ได้รับการวิเคราะห์เพื่อประเมินการใช้ผลการคัดเลือกแพทย์ประจำบ้านในการทำนายความสามารถทางคลินิกของแพทย์ประจำบ้าน จากการวิเคราะห์ความสัมพันธ์ระหว่างคะแนนคัดเลือกแพทย์ประจำบ้านที่ได้จากเกรดเฉลี่ยสะสมในโรงเรียนแพทย์ จดหมายแนะนำตัว และคะแนนการสอบสัมภาษณ์ กับผลการประเมินการปฏิบัติงานของแพทย์ประจำบ้าน พบว่าคะแนนการสอบสัมภาษณ์เป็นตัวทำนายที่ดีที่สุดสำหรับทำนายผลการปฏิบัติงานโดยรวมของแพทย์ประจำบ้านชั้นปีที่ 1 และ 2 ส่วนเกรดเฉลี่ยสะสมในโรงเรียนแพทย์จัดเป็นตัวทำนายที่ดีที่สุดสำหรับทำนายผลการปฏิบัติงานโดยรวมของแพทย์ประจำบ้านชั้นปีที่ 3 พบว่าเกณฑ์การคัดเลือกแพทย์ประจำบ้านแต่ละเกณฑ์มีประโยชน์ต่อการทำนายความสามารถทางคลินิกของแพทย์ประจำบ้านแตกต่างกัน การทำนายความสามารถทางคลินิกจากผลการประเมินด้วยเกณฑ์การคัดเลือกมากกว่า 1 เกณฑ์มีความแม่นยำในการทำนายสูงกว่าการทำนายด้วยเกณฑ์การคัดเลือกเกณฑ์ใดเกณฑ์หนึ่ง เมื่อใช้คะแนนจากการสอบสัมภาษณ์ร่วมกับคะแนนจากจดหมายแนะนำตัว คะแนนเฉลี่ยสะสมจากโรงเรียนแพทย์ และอายุของผู้สมัคร ทำนายความสามารถทางคลินิกโดยรวมของแพทย์ประจำบ้านชั้นปีที่ 1 พบว่าสามารถอธิบายความแตกต่างของผลการประเมินแพทย์ประจำบ้านได้ร้อยละ 60.5 ($R = 0.778, p = 0.012$) เมื่อใช้คะแนนจากการสอบสัมภาษณ์ร่วมกับคะแนนจากจดหมายแนะนำตัว ทำนายความสามารถทางคลินิกโดยรวมของแพทย์ประจำบ้านชั้นปีที่ 2 พบว่าสามารถทำนายความแตกต่างของผลการประเมินแพทย์ประจำบ้านได้ร้อยละ 31.4 ($R = 0.56$, $p = 0.049$) อย่างไรก็ตามในการศึกษานี้ไม่พบว่าผลการคัดเลือกแพทย์ประจำบ้านสามารถใช้ทำนายผลการประเมินการปฏิบัติงานโดยรวมของแพทย์ประจำบ้านชั้นปีที่ 3 ได้แม่นยำอย่างมีนัยสำคัญทางสถิติ

INTRODUCTION

The principal goal of resident selection is to identify applicants who will perform well during residency. The faculty of residency program spends a considerable amount of time and effort evaluating applicants in the selection process. In this process, resident selection committees typically gather data from medical school transcripts, letters of recommendation, Dean's letters, personal statements, curricula vitae, standardized test scores, and formal interviews.[1-5]

During the past few decades, questions have been raised about the process and criteria used in residency selection. In an effort to improve the resident selection process, the factors involved in the recruitment of residents have been extensively studied for over thirty years.[1,4,6-9]

There have been studies which demonstrated that as the competition for specialty training position was increasing, its residency programs relied more heavily on academic credentials in the selection process.[6,10] This trend was based on findings from many studies that showed a positive relationship between medical school performance and performance during residency training.[11-13] However, this increasing reliance on academic achievement predictors ignored findings from some studies that showed a lack of predictive ability of these measures.[2,9] Non-cognitive factors such as conscientiousness and interpersonal skills were demonstrated to be as important as cognitive factors in the prediction of resident behavior and performance.[14,15] It was also shown that most of the problems during residency appeared to be related to personal and motivational factors rather than to skills- or knowledge-related factors.[16]

Despite these efforts, the process of resident selection remains an area filled with tradition and sparse in scientific rigor.[4,17] There is still relatively little known about the validity and reliability of

evaluation criteria used in the resident selection process. There is also no consensus regarding the appropriate weighing of these selection criteria.

The purpose of this study was to evaluate the ability of resident selection criteria used at the Department of Surgery, Faculty of Medicine Siriraj Hospital in predicting clinical performance of general surgery residents in the training program. The results from this study will be useful for the Department of Surgery, Faculty of Medicine Siriraj Hospital as one piece of valid evidence for this selection process. The results will also help the resident selection committee decide how to appropriately adjust weighing for each selection criterion and guide future direction for improving the resident selection process.

MATERIALS AND METHODS

This was a retrospective study of the original application files and resident evaluations of 35 general surgery residents who were in the residency program of the Department of Surgery, Faculty of Medicine Siriraj Hospital during the 2000 - 2001 and 2001 - 2002 academic years. The data used in the analysis included applicants' basic demographic characteristics (age, gender, marital status, and graduated medical school), scores obtained from the resident selection process (GPA scores, scores from letters of recommendation, and interview scores), and clinical performance assessment during residency.

The Department of Surgery, Faculty of Medicine Siriraj Hospital had a quota of eight to ten positions for admission of new general surgery residents each year. The chairman of the department appointed a new resident selection committee to select appropriate candidates into the residency program every year. This committee was composed of the chairman of the department, nine heads of surgical divisions, the director of the surgical residency program, and a selected member of the education committee of the department. The resident selection committee selected candidates based on three main criteria: medical school grades, letters of recommendation, and an interview.

The medical school grades were obtained from medical school transcripts. The grading system used was a letter grading system based on a four-point scale with a 0.5 point increment. The medical school grade of each applicant was converted to a GPA score which was a percentage of the highest possible grade point average (4.00). The GPA score was then combined with scores from letters of recommendation and an interview to make a final decision in resident selection.

Each applicant was required to submit three letters of recommendation from their supervisors or medical school professors who were familiar with their academic qualifications and clinical working experiences. Letters of recommendation of each applicant were reviewed by each member of the resident selection committee who independently assigned a score from 0 (the worst) to 30 (the best). Scores from all members of the resident selection committee were added together and converted into a percentage score for each applicant to combine with the GPA score and the interview score later.

The interview format used at the Department of Surgery, Faculty of Medicine Siriraj Hospital was an unstructured interview. Each applicant was interviewed by all members of the resident selection committee for approximately 15 - 20 minutes. The interviewers had access to the applicants' files, and thus were not blind to the applicants' objective data. The questions used in the interview were not standardized. Each interviewer was free to ask any questions. The questions asked varied from one applicant to another. However, there were guidelines distributed to the interviewers advising key characteristics to be assessed in the interview. These characteristics were attitudes toward the surgical training program and the institution, knowledge, decision making and problem solving skills, curiosity, interpersonal skills, creativity, altruism, emotional maturity, and special abilities. Each member of the resident selection committee independently assigned a score from 0 (the worst) to 40 (the best) for each applicant. The scores were summed up and converted into a percentage score for each applicant to combine with the GPA score and the score from letters of recommendation.

The weighing systems used to combine the three resident selection scores were varied between years. In the 1998 residency selection (which was the selection of third-year residents in the 2000 -

2001 academic year), the committee weighed 40, 30, and 30 percents for GPA score, score from letters of recommendation, and interview score, respectively. In the 1999 - 2001 resident selection, the weights used were 30, 30, and 40 percents for GPA score, score from letters of recommendation, and interview score, respectively.

The clinical performance during residency was assessed with the clinical performance ratings. Each resident was evaluated by attending faculty once at the end of each rotation using a standardized rating form. Eleven components evaluated in this rating form were knowledge, clinical judgment, curiosity, work concentration, work effectiveness, medical records, punctuality, responsibility, relationship with patients, relationship with other doctors, and relationship with other health care workers. Each of these components was independently rated on a scale from one to five where five was the best. The general surgery residency at the Department of Surgery, Faculty of Medicine Siriraj Hospital was a three-year program. Each resident worked in 9 - 13 rotations per year. At the end of each year, all the ratings were summarized into a percentage score of overall performance of each resident.

Basic demographic characteristics of subjects were analyzed for descriptive statistics to provide information for population generalizability. Mean overall performance scores were compared between groups of subjects with different demographic characteristics (gender, marital status, and graduated institution) using two-independent-samples two-tailed t test to check for the effects of these variables on clinical performance. The effect of age on clinical performance was also checked by Pearson correlation study. To determine the predictive ability of resident selection criteria, scores from each selection criterion were correlated with each component of clinical performance evaluation in each year of residency. To examine the benefit of using all three selection criteria in the resident selection, multiple regression analyses were done using scores from all three selection criteria as predictors and overall performance scores of residents as outcomes.

RESULTS

A. Subjects' Characteristics

There were 35 residents in the general surgery residency program of the Department of Surgery, Faculty of Medicine Siriraj Hospital during the 2000 - 2001 and 2001 - 2002 academic years. Seven of them were recruited into the program in the 1998 residency selection. Ten were recruited in the 1999 residency selection. Nine were recruited in the 2000 residency selection. And nine were from the 2001 residency selection. The ages at admission of these residents ranged from 22 to 28 years with the mean age of 24.97 years and a standard deviation of 1.5 years. Their medical school grades ranged from 2.4 to 3.9 with the mean grade of 3.02 and a standard deviation of 0.41. Thirty-one residents (88.6%) were male. Thirty-three of them (94.3%) were not married. Thirty-one of them (88.6%) had graduated with the doctor of medicine degree from the Faculty of Medicine Siriraj Hospital. These basic subjects' characteristics are summarized in Table 1.

Table 1. Demographic characteristics of residents in the study.

	Recruitment year				
	1998	1999	2000	2001	Total
Number of residents	7	10	9	9	35 (100%)
Male	7	8	7	9	31 (88.6%)
Married	1	0	1	0	2 (5.7%)
Graduated from Siriraj Hospital	5	9	8	9	31 (88.6%)

Using two-independent-samples two-tailed t test, mean overall performance scores of residents in the first, second and third year of training were not statistically different between groups of subjects with different gender, marital status, and graduated institution. The Pearson correlation study between ages of subjects on admission and their overall performance scores showed no statistically significant relationship between age and clinical performance in the second and third year of residency. However, there was a negative correlation between age and clinical performance in the first year of residency ($r = -0.527$, $p = 0.025$).

B. Resident Selection Scores

The GPA scores of these residents ranged from 60.0 to 97.5 with a mean of 75.60 and a standard deviation of 10.29. The scores from letters of recommendation were in the range of 77.0 to 95.8 with a mean of 85.71 and a standard deviation of 4.44. The interview scores ranged from 73.15 to 95.57 with a mean of 84.67 and a standard deviation of 4.04.

Scores from these three selection criteria correlated significantly with one another. The correlation coefficient between the GPA scores and the scores from letters of recommendation was 0.42 ($p = 0.01$). The correlation coefficient between the GPA scores and the interview scores was 0.627 ($p = 0.00$). The correlation coefficient between the interview scores and the scores from letters of recommendation was 0.541 ($p = 0.00$). The constructs evaluated by these selection criteria significantly overlapped with one another. Significant percentage of variability of one selection criterion can be attributed to differences in the scores of other selection criteria. However, most of the variability of scores of these criteria was not explained by differences of scores on the other two criteria. Using all three criteria can provide the resident selection committee with a broader evaluation of applicants.

C. Resident Performance Measures

Eighteen residents had clinical performance ratings for their first-year residency. Their overall performance scores ranged from 76.02 to 86.33 with a mean of 81.54 and a standard deviation of 2.67. Overall performance scores of 19 residents in the second year were in the range of 72.35 to 88.47 with a mean score of 81.12 and a standard deviation of 4.00. For the third year residents, 17 residents had overall performance scores ranging from 70.51 to 91.35 with an average score of 83.07 and a standard deviation of 5.00. The mean score of each component of clinical performance ratings and overall performance scores are summarized in Table 2.

D. Correlation Study

Correlation coefficients between predictors (resident selection scores) and outcomes (resident performance ratings) are summarized in Table 3.

Table 2. Mean scores of clinical performance ratings of residents in the study.

	Residence year		
	1 (n = 18)	**2 (n = 19)**	**3 (n = 17)**
Knowledge	3.76	3.83	3.98
Clinical judgment	3.81	3.91	4.05
Curiosity	4.07	4.07	4.17
Work concentration	4.31	4.28	4.31
Work effectiveness	4.15	4.15	4.21
Medical records	3.72	3.78	3.87
Punctuality	4.18	4.13	4.22
Responsibility	4.27	4.26	4.32
Relationship with patients	4.17	3.97	4.17
Relationship with other doctors	4.22	4.22	4.21
Relationship with other workers	4.18	4.01	4.19
Overall performance	81.54	81.12	83.07

Table 3. Correlation coefficients between predictor and outcome variables of residents in the three residency years.

Outcomes	GPA scores			Scores from letters of recommendation			Interview scores		
	1	2	3	1	2	3	1	2	3
Knowledge	0.72**	0.55*	0.67**	0.20	0.34	0.19	0.72**	0.39	0.40
Clinical judgment	0.64**	0.15	0.52*	0.17	0.13	0.01	0.76**	0.22	0.14
Curiosity	0.69**	0.35	0.42	0.31	0.30	0.06	0.67**	0.53*	0.27
Work concentration	0.48*	0.25	0.34	0.44	0.12	0.02	0.45	0.44	0.18
Work effectiveness	0.44	0.37	0.36	0.30	0.16	0.04	0.64**	0.33	0.14
Medical records	0.42	0.01	0.57*	0.39	0.27	0.06	0.73**	0.28	0.37
Punctuality	0.33	0.27	0.55*	0.49*	0.05	0.08	0.34	0.47*	0.34
Responsibility	0.27	0.15	0.37	0.47	0.10	0.26	0.35	0.43	0.35
Relationship with patients	0.28	-0.04	0.18	0.35	-0.02	0.04	0.28	0.38	0.17
Relationship with other doctors	0.18	0.06	0.26	0.46	0.09	0.05	0.24	0.38	0.21
Relationship with other workers	0.17	0.33	0.23	0.51*	0.15	0.04	0.21	0.56*	0.19
Overall performance	0.56*	0.27	0.44	0.44	0.18	0.08	0.65**	0.51*	0.26

*Correlation is significant at 0.05 level (2-tailed). **Correlation is significant at 0.01 level (2-tailed).

Table 4. Regression models predicting overall resident performance obtained from analyses.

Outcomes	Predictors	Models	R	R^2	p
First-year performance	I, L	Y = 36.08 + 0.36I + 0.19L	0.71	0.50	0.006
	I, L, G, A	Y = 71.15 + 0.45I + 0.11L - 0.12G - 1.1A	0.78	0.61	0.012
Second-year performance	I, L	Y = 51.34 + 0.73I - 0.36L	0.56	0.31	0.049
Third-year performance	G	Y = 65.98 + 0.22G	0.44	0.19	0.079

A = age at admission (years), G = GPA score (percent), I = interview score (percent), L = score from letters of recommendation (percent), Y = overall performance score (percent).

GPA scores were significantly correlated with many important components of clinical performance in the first year of residency including knowledge, clinical judgment, curiosity, work concentration, and overall first-year performance. GPA scores also significantly correlated with many third-year ratings including knowledge, clinical judgment, medical records, and punctuality. However, they correlated with only ratings in knowledge in the second year residency. All of these relationships were large enough to be of practical as well as theoretical use.[18]

Scores from letters of recommendation had significant correlations with only punctuality and relationship with other health care workers in the second year of residency. The magnitudes of correlation coefficients found were considerably less than

those found in the study of GPA scores. However, they were still large enough to have some practical values.

Interview scores were good predictors of many performance ratings in the first and second years. Interview scores strongly correlated with many ratings in the first year residency including knowledge, clinical judgment, curiosity, work effectiveness, medical records, and overall first-year performance. The magnitudes of correlation coefficients found here demonstrated very important relationships rarely obtained in educational research.[18] Interview scores were also significantly correlated with performance ratings in the second year including curiosity, punctuality, relationship with other health care workers, and overall second-year performance. However, no significant relationships were demonstrated between interview scores and performance ratings in the third year.

When using all three selection criteria to predict overall first-year performance, the best multiple regression model was the one that used interview scores and scores from letters of recommendation which could predict 49.8% of the total variance in the overall first-year performance scores ($R = 0.71$, $p = 0.006$). Considering a moderate degree of correlation between ages at admission and overall first-year performance scores demonstrated earlier, ages at admission were also used as one of the predictors. A multiple regression model which used ages at admission as well as all three selection criteria as predictors could predict 60.5% of the total variance in the overall first-year performance scores ($R = 0.778$, $p = 0.012$).

In predicting overall performance in the second year, the best multiple regression model obtained from the study was the one that used interview scores and scores from letters of recommendation which could predict 31.4% of the total variance in the overall performance scores in the second year ($R = 0.56$, $p = 0.049$).

For the third-year overall performance, none of the multiple regression models demonstrated a statistically significant prediction. The best model obtained from the analysis was the one that used only GPA scores and had a coefficient of multiple regression (R) of 0.44 at the significant level of 0.079.

Findings from these multiple regression analyses are summarized in Table 4.

DISCUSSION

Comparison of means of overall clinical performance scores of subjects with different genders, marital status, and graduated institutions showed that these subjects' characteristics did not significantly affect clinical performance in residency training. From correlation study, age of subject had some effects on clinical performance in the first year of training. Residents with younger ages had better overall performance scores in the first year. However, age did not affect clinical performance in the second and third year of residency.

The GPA scores had a wide range of 37.5 with a standard deviation of 10.29. Scores from letters of recommendation and interview scores had more limited score ranges with standard deviations of only 4.44 and 4.04 respectively. Restriction in the ranges of these predictors might limit the magnitudes of their correlation coefficients. This was an inevitable limitation in the study of resident selection. The resident selection committee always recruited only applicants with high scores into the program. Applicants with lower scores on these criteria were not selected into the program and were not included in the study. This is one of the limitations for implication of the study results.

Correlation study between the three resident selection criteria demonstrated that although there was a shared area of evaluated constructs, each of them also assessed unique constructs that differed from those of the other two. This supported the use of all three criteria in the resident selection process. Combining all three selection criteria would allow the resident selection committee to have a more comprehensive evaluation of each resident than using only one or two of them.

The GPA scores significantly correlated with many measured outcomes in all three years of residency. The GPA scores were a very strong predictor for ratings in knowledge in all three years of residency. They also had a significant value in predicting clinical judgment of residents. Compared with the other two selection criteria, the outstanding value of the GPA scores was in the prediction of clinical performance in the third year. The predictive ability of the GPA scores seemed to be more stable over time than the other two criteria.

The scores from letters of recommendation were the weakest predictor among the three selec-

tion criteria. They had significant correlations with only two outcomes in the first year of residency. The limited ability of this selection criterion in predicting resident performance demonstrated its limited value in resident selection. This is an important area that the Department of Surgery can consider as an opportunity to improve the quality of the resident selection process in the future.

The interview scores were the strongest predictor among the three selection criteria in predicting clinical performance of residents in the first and second years. The diminished ability of the interview scores in predicting performance in the third year could be the effects of maturation. Maturity and changes in skill levels that occurred as a result of training should account for some degradation in correlation coefficients.

The areas of clinical performance that could not be predicted by all these three selection criteria were responsibility, relationship with patients, and relationship with other doctors. The Department of Surgery should consider adjusting some details of selection criteria consideration to improve the assessment of these characteristics.

From multiple regression analyses, the value of using all three criteria in the resident selection was emphasized. Each of the selection criteria contributed something unique to the prediction of resident performance. Using multiple predictors provided a more accurate prediction than using any single predictor alone. Combination of interview scores, scores from letters of recommendation, GPA scores, and ages of applicants was the best predictor for overall clinical performance in the first year. Combination of interview scores and scores from letters of recommendation was the best predictor for overall clinical performance in the second year. Unfortunately, overall clinical performance in the third year could not be accurately predicted with combination of these criteria with a significant level of confidence. The degradation of coefficients of multiple regression in the prediction of clinical performance from the first to the third year also demonstrated the effects of maturation and changes in skills of these residents.

The results from this study demonstrated validity of using these three criteria in the resident selection process of the Department of Surgery, Faculty of Medicine Siriraj Hospital. These selection criteria could predict clinical performance during the residency with a moderate to high level of accuracy especially in the first year of the program. The findings from this study can also guide the future direction for improving the quality of the resident selection process of the Department of Surgery, Faculty of Medicine Siriraj Hospital. The weakest selection criterion, and found to be in need of improvement, was letters of recommendation. A potential way to improve the quality of the evaluation of letters of recommendation would be to use a standard format for the letters of recommendation, provide guidelines for writers of letters of recommendation, or develop standard criteria for scoring of letters of recommendation such as a behaviorally-anchored ranking scale.[19] In the meantime, while adjusting the evaluation criteria of letters of recommendation, the resident selection committee may consider applying less weight to scores from letters of recommendation than to the other two selection criteria.

Although the GPA scores could predict clinical performance in residency program with moderate level of accuracy in many aspects, there were still some areas for improvement. Many areas of clinical performance in residency program could not be predicted by the GPA scores including work effectiveness, responsibility, relationship with patients, relationship with other doctors, and relationship with other health care workers. The other noteworthy weakness of the GPA scores was in the prediction of the performance in the second year of residency. There was evidence that clinical grades predicted resident performance better than did basic science grades.[20] The Department of Surgery, Faculty of Medicine Siriraj Hospital might consider more detailed evaluation of applicants' medical school grades including clinical grades and grades from the surgical clerkship.

Despite the accuracy of many performance ratings in the first year predicted by the interview scores, there was still room for improvement, especially in prediction of work concentration, punctuality, responsibility, relationship with patients, relationship with other doctors, and relationship with other health care workers. The Department of Surgery might consider revising the interviewing guideline to assess these characteristics more completely. The other possible way to improve the interview may be to use a standardized behavior-based accomplish-

ment interview which has been demonstrated to have added predictive utility to the traditional interview.[21]

CONCLUSION

The validity of the use of medical school grades, letters of recommendation, and formal interview in selecting general surgery residents by the Department of Surgery, Faculty of Medicine Siriraj Hospital was supported by findings from this study. Each selection criterion contributed something unique to the prediction of resident performance. Combination of these selection criteria can predict resident performance with moderate to high degree of accuracy, especially in predicting clinical performance in the first year of residency. The predictive power of these criteria decreased as residents progressed into the higher years of residency. The interview scores were the best predictor for overall performance in the first and second years of residency while the GPA scores were the best predictor for overall performance in the third year.

REFERENCES

1. Bernstein AD, Jazrawi LM, Elbeshbeshy B, Valle CJ, Zuckerman J. Orthopaedic resident-selection criteria. J Bone Joint Surg 2002; **84:** 2090-96.
2. Borowitz SM, Saulsbury FT, Wilson WG. Information collected during the residency match process does not predict clinical performance. Arch Pediatr Adolesc Med 2000; **154:** 256-60.
3. Khongphatthanayothin A, Chongsrisawat V, Wananukul S, Sanpavat S. Resident recruitment: What are good predictors for performance during pediatric residency training? J Med Assoc Thai 2002; **85(Suppl 1):** S302-11.
4. Provan JL, Cuttress L. Preferences of program directors for evaluation of candidates for postgraduate training. Can Med Assoc J 1995; **153:** 919-23.
5. Taylor CA, Weinstein L, Mayhew HE. The process of resident selection: A view from the residency director's desk. Obstet Gynecol 1995; **85:** 299-303.
6. Wagoner NE, Suriano JR, Stoner JA. Factors used by program directors to delect residents. J Med Educ 1986; **61:** 10-21.
7. Wagoner NE, Suriano JR. Recommendations for changing the residency selection process based on a survey of program directors. Acad Med 1992; **67:** 459-65.
8. Ross CA, Leichner P. Criteria for selecting residents: A reassessment. Can J Psychiatr 1984; **29:** 681-86.
9. Papp KK, Polk HC Jr, Richardson JD. The relationship between criteria used to select residents and performance during residency. Am J Surg 1997; **173:** 326-29.
10. Wagoner NE, Suriano JR. Program directors' responses to a survey on variables used to select residents in a time of change. Acad Med 1999; **74:** 51-58.
11. Markert RJ. The relationship of academic measures in medical school to performance after graduation. Acad Med 1993; **68(Suppl 2):** S31-34.
12. Erlandson EE, Calhoun JG, Barrack FM, et al. Resident selection: Applicant selection criteria compared with performance. Surgery 1982; **92:** 270-75.
13. Gunzburger LK, Frazier RG, Yang LM, Rainey ML, Wronski T. Premedical and medical school performance in predicting first-year residency performance. J Med Educ 1987; **62:** 379-84.
14. Wood PS, Smith WL, Altmaier EM, Tarico VS, Franken EA Jr. A prospective study of cognitive and noncognitive selection criteria as predictors of resident performance. Invest Radiol 1990; **25:** 855-59.
15. Tarico VS, Altmaier EM, Smith WL, Franken EA Jr. Development and validation of an accomplishment interview for radiology residents. J Med Educ 1986; **61:** 845-47.
16. Brown E, Rosinski EF, Altman DF. Comparing medical school graduates who perform poorly in residency with graduates who perform well. Acad Med 1993; **68:** 806-8.
17. Gilbart MK, Cusimano MD, Regehr G. Evaluating surgical resident selection procedures. Am J Surg 2001; **181:** 221-25.
18. Fraenkel JR, Wallen NE. Statistics in perspective. In : Fraenkel JR, Wallen NE, eds. How to design and evaluate research in education? 5th ed. New York: McGraw-Hill, 2003: 252-64.
19. Doutre WH, Buesing AS, Ingrim NB, et al. Behaviorally anchored ranking scale versus letters of recommendation for evaluating residency candidates. Amer J Hosp Pharm 1984; **41:** 2367-70.
20. Fine PL, Hayward RA. Do the criteria of resident selection committees predict residents' performances? Acad Med 1995; **70:** 834-38.
21. Altmaier EM, Smith WL, O'Halloran CM, Franken EA Jr. The predictive utility of behavior-based interviewing compared with traditional interviewing in the selection of radiology residents. Invest Radiol 1992; **27:** 385-89.