Original Contribution

The predictive value of pre-recruitment achievement on resident performance in anesthesiology☆

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ABSTRACT

Study objective: Selecting candidates for residency positions is challenging and there is little research on the correlation between commonly used selection criteria and subsequent performance in anesthesiology. This study examined the association between the selection measures and post-recruitment performance in residency.
Design: Retrospective review of archival data.
Setting: Anesthesiology residency program at a large academic anesthesiology department.
Subjects: Residents who were matched to the anesthesiology program over 9 years (graduation classes of 2006 to 2014).
Interventions: None.
Measurements: The pre-recruitment achievements included a comprehensive list of measures obtained from residents' application portfolios in conjunction with interview performance. The post-recruitment examination outcomes consisted of the in-training examination (ITE) scores in the three clinical anesthesia (CA) years and first-attempt success on the written board certification examination administered by the American Board of Anesthesiology (ABA). Scholarly output during residency was measured by publication record. Clinical performance at the conclusion of residency was independently rated by three faculty members. Bivariate analysis and regression models were conducted to examine association between predictors and outcomes.
Main results: High United States Medical Licensing Examination (USMLE) scores, class rank in medical school and interview performance were predictive of high examination scores in residency and good clinical performance. Class rank appeared to be the best predictor of scholarly publication and pursuing an academic career beyond residency.
Conclusions: Comparative performance with classmates (i.e., class rank) in medical school appeared to be an effective predictor of overall performance in residency, which warrants more attention in future study. Although interview performance is subject to recruitment team members' interpretation, it is an important measure to include in recruitment decisions.

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1. Introduction

Selecting the best-suited applicants for anesthesiology residency is critical for the applicants, the program, and future patients. Each year, program directors and faculty across anesthesiology residency programs dedicate significant time and resources to the residency selection

process. However, the measures that best predict successful anesthesiology residency performance remain elusive.

The links between pre-recruitment selection criteria and success as a resident have been investigated across several specialties [1,2,3,4,5,6,7,8,9,10,11,12]. Findings from other specialties, however, may or may not be applicable to anesthesiology as competencies and characteristics required for success in each specialty can be substantially different. For example, studies showed that empathy and communication are more valued for recruitment decisions in general practice and pediatrics, whereas vigilance and situational awareness were weighted more heavily in anesthesiology [13].

To our knowledge, only two studies have investigated the predictive value of commonly used selection measures on anesthesiology residency performance, and the metrics examined were limited in variety and

numbers. Metro et al. [14] did not find correlation between residents' composite scores assigned by the recruitment committee and the measures used to evaluate their performance throughout residency except for In Training Exam (ITE) scores. The performance measures included faculty year-end evaluations on knowledge, judgment, motor skills, pre-anesthetic assessment planning, work habits, intrapersonal attitudes, intrapersonal attributes and overall impression. More recently, Guffey et al.'s single site study examined the value of United States Medical Licensing Examination (USMLE) scores as a predictor of performance on the ITE and the American Board of Anesthesiology (ABA) written examination [15]. Although Guffey et al. found a positive association between USMLE scores and ITE and ABA written examination scores in anesthesiology residents, they did not investigate any other recruitment metrics. A comprehensive examination to assess the predictive value and relative importance of pre-recruitment achievements on post-recruitment performance during residency training in anesthesiology is warranted.

This study examined the association between some of the commonly used selection measures and residents' post-recruitment performance in examinations, clinical settings, and scholarly output. We hypothesized that USMLE scores would significantly correlate with resident performance on examinations but may be less associated with clinical performance or scholarly output. More importantly, we hypothesized that comparative clinical performance with classmates, honor society membership (i.e., Alpha Omega Alpha [AOA]), clinical grades, and medical school attended would correlate with clinical performance but not necessarily with examination scores in residency. These measures have been found to be associated with residency performance in other specialties, but have not yet been examined in anesthesia [16]. We also included interview performance, the undergraduate college attended, additional degree obtained, self-reported experience in research, leadership and service as factors that may be potentially useful in predicting residency performance. Additionally, we included career choice after completion of residency as an outcome variable in order to examine whether some of the pre-recruitment characteristics may predict career choice (i.e., private practice or academic faculty positions) after the completion of residency and fellowship training. Admittedly, this analysis is exploratory; residents' career choice may largely be influenced by personal preference and job availability upon graduation, and should not be considered a measure of residency success. Furthermore, we aimed to identify the strongest predictive factors for each of the outcomes.

2. Materials and methods

2.1. Design and sample

This is a single-site retrospective study. After obtaining institutional review board approval at the University of North Carolina at Chapel Hill, we reviewed residency application data in Electronic Residency Application Service (ERAS) and departmental residency archives for all residents that matched in our anesthesiology residency program over a nine-year period (graduation classes of 2006 to 2014). The final sample consisted of a total of 122 residents, including 57 males and 65 females. Three residents who graduated from international colleges or medical schools were excluded from analysis involving college and/or medical school rankings. Residents with Doctor of Osteopathic Medicine (DO) degrees were excluded from analysis involving clerkship grades as well as USMLE scores if they did not take these exams.

2.2. Measures

Table 1 summarizes the variables and their measures included in this study. All objective data except for class rank were extracted from the residents' portfolios. Four attending physicians reviewed resident portfolios to identify class rank, anesthesiology rotation grade, as well

as the number of "honor" clerkship grades. They then assigned scores for research, leadership, service and letters of recommendation using a standardized rubric specific to each measure (Appendix A). The rubrics were designed with a modified Delphi technique. The portfolios were divided among the four reviewers and each resident was reviewed by two reviewers. The interrater agreement was good for research (intraclass correlation coefficient [ICC] = 0.87), leadership (ICC = 0.79) and services (ICC = 0.68). The score for letters of recommendation was excluded from analysis due to low interrater reliability (ICC = 0.39).

Sixty-one residents had medical school class rank by quartile specifically noted in their application portfolio. For those who did not, class rank was independently estimated by two reviewers based on grade distribution. Fifty-five residents received the same estimated score from the two raters. There was disagreement between reviewers in the estimated class rank for six residents. For these six residents, a third rater reviewed their application portfolios and determined the final assigned class rank.

Table 1
Variable descriptions.

Type	Name	Description
Predictor	Step1	USMLE step 1 score
	Step2	USMLE step 2 score
	Degree	Additional advanced degrees other than MD/DO (1 = yes, 0 = no)
	AOA	AOA membership in medical school (1 = yes, 0 = no, did not distinguish between senior and junior induction)
	College	Undergraduate college rankings based on U.S. News & World Report 2016 rankings 1. First tier: top 25 ranked national universities and top 10 ranked national liberal arts colleges 2. Second tier: 26–50 national universities and 11–20 liberal arts colleges 3. Third tier: all others
	MEDR	Medical school rankings based on U.S. News & World Report 2016 rankings for national medical schools (research). 1. First tier: top 20 2. Second tier: 21–40 3. Third tier: all others
	Anesrotation	Anesthesia rotation grade in medical school (2 = H, 1 = HP, 0 = None)
	Clerkship	Number of honors for core clerkship grades in medical school
	Classrank	Class rank in medical school (Quartiles, 4 = high-ranking, 1 = low-ranking)
	Research	Pre-recruitment research experience (5-point scale, 1–5)
	Leadership	Pre-recruitment leadership (5-point scale, 1–5)
	Service	Pre-recruitment service/volunteerism (5-point scale, 1–5)
	LOR	Letters of recommendation (5-point scale, 1–5)
	Interview	Recruitment interview score administered by the recruitment committee (1–24, 24 being the best, 1 being the least desirable)
Outcome	ITE1	ITE score in CA 1 year
	ITE2	ITE score in CA 2 year
	ITE3	ITE score in CA 3 year
	PART1	ABA written certification examination first attempt success (1 = pass, 0 = fail)
	Publication	One or more peer-reviewed journal articles published during residency (or within 1 year after graduation from residency) (1 = yes, 0 = no)
	Clinical	The clinical performance quality at the conclusion of residency (10-point scale)
	Job	Academic career (1 = yes, 0 = no)

Note: USMLE: United States Medical Licensing Examination; MD: Doctor of Medicine; DO: Doctor of Osteopathic Medicine; AOA: Alpha Omega Alpha Honor; ITE: In-Training Examination; ABA: The American Board of Anesthesiology.