USMLE Step 2 CK: Best Predictor of Multimodal Performance in an Internal Medicine Residency

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ABSTRACT

Background Internal medicine (IM) residency programs receive information about applicants via academic transcripts, but studies demonstrate wide variability in satisfaction with and usefulness of this information. In addition, many studies compare application materials to only 1 or 2 assessment metrics, usually standardized test scores and work-based observational faculty assessments.

Objective We sought to determine which application materials best predict performance across a broad array of residency assessment outcomes generated by standardized testing and a yearlong IM residency ambulatory long block.

Methods In 2019, we analyzed available Electronic Residency Application Service data for 167 categorical IM residents, including advanced degree status, research experience, failures during medical school, undergraduate medical education award status, and United States Medical Licensing Examination (USMLE) scores. We compared these with post-match residency multimodal performance, including standardized test scores and faculty member, peer, allied health professional, and patient-level assessment measures.

Results In multivariate analyses, USMLE Step 2 Clinical Knowledge (CK) scores were most predictive of performance across all residency performance domains measured. Having an advanced degree was associated with higher patient-level assessments (eg, physician listens, physician explains, etc). USMLE Step 1 scores were associated with in-training examination scores only. None of the other measured application materials predicted performance.

Conclusions USMLE Step 2 CK scores were the highest predictors of residency performance across a broad array of performance measurements generated by standardized testing and an IM residency ambulatory long block.

Introduction

Internal medicine (IM) residency programs receive large amounts of information about applicants, including academic transcripts, the Medical Student Performance Evaluation (MSPE), letters of recommendation (LORs), and United States Medical Licensing Examination (USMLE) scores. However, studies across many specialties demonstrate wide variability in satisfaction and usefulness of this information in selecting residents during the application process.[1–5] The MSPE, despite recent efforts at improvement, often lacks transparency and standardization, making it difficult to interpret during the selection process.[6,7] Evidence is mixed about LOR predictive value. One small study showed successful residents had more LOR comments about excellence in the Accreditation Council for Graduate Medical Education core competency areas of patient care, medical knowledge, and interpersonal and communication skills,[8] but other studies found little value of LOR altogether for residency selection or resident performance.[1,9,10]

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Because of these issues, use of USMLE Step 1 scores as a prominent applicant selection tool has intensified in recent years.[11] Most studies show USMLE Step 1 largely predicts future test scores, such as in-training examinations (ITEs) and specialty board examinations, but not competency domains such as communication, teamwork, and professionalism.[12–18] Studies that have shown a connection between USMLE Step 1 and global performance generally have weak associations,[19,20] limited scope of comparisons (ie, just faculty assessment),[21] or were in fields other than IM.[19–21] Despite the heavy reliance on USMLE Step 1 scores, recent studies suggested USMLE Step 2 Clinical Knowledge (CK) actually may be a better predictor of ITE scores and resident performance overall.[22–25]

Many of these studies compare application materials to only 1 or 2 other assessment metrics, usually standardized test scores and work-based observational faculty assessments. We believe these limited forms of assessment, while valuable, are not enough to fully capture a physician's competence.[26] At the University of Cincinnati, we created a robust program of assessment,[26] consisting of multimodal performance data including faculty member, peer, allied health professional, and patient-level assessment, as well as

standardized test scores.[27,28] In this retrospective study, we examine which application materials best predict performance across this broader array of residency assessment outcomes.

What was known and gap
Use of USMLE 1 scores as an applicant selection tool for residency programs has increased variability in usefulness of other performance metrics, but studies across many specialties demonstrate wide variability in using this information to select residents during the application process.

What is new
An analysis of Electronic Residency Application Service (ERAS) data for categorical internal medicine (IM) residents compared with a robust program of assessment of resident performance during a yearlong ambulatory block.

Limitations
Study was completed at a single institution and all clinical performance was measured from a unique IM residency ambulatory long block structure, limiting generalizability.

Bottom line
The USMLE Step 2 CK was the best predictor of residency performance on standardized testing during and after residency, as well as clinical performance from multiple perspectives during a yearlong ambulatory long block continuity experience.

Methods

The University of Cincinnati IM Residency Program is based in an urban academic medical center. Categorical IM classes consist of approximately 25 residents who are accepted through the National Resident Matching Program (NRMP). The program director (PD) and 2 faculty members interview each resident during the recruitment season. The entirety of each application is reviewed by the interviewers. Information gathered from this process is submitted to the residency selection committee to develop a rank list for submission to the NRMP.

Inclusion criteria for this study consisted of categorical residents who matriculated to our program from 2007 to 2014 (167 total). Final analysis of the data was conducted in 2019. Applicants were excluded if they were preliminary residents, clinical scientist track program residents, part of combined programs (eg, IM–pediatrics) or had transferred from another program after their first year. We analyzed selected Electronic Residency Application Service (ERAS) data, including the presence of an advanced degree, the number of research experiences (defined here as publications and posters), the presence of failures during medical school (reported examinations, clerkships, basic science courses, or USMLE), Alpha Omega Alpha Honor Medical Society awards, Humanism in Medicine awards, or other undergraduate medical education (UME) award status, and USMLE Step 1 and 2 CK scores. We excluded class rank and clerkship grades because of the extreme variability in the way these are determined among medical schools (including some schools that use pass-fail for these measures), making direct comparison difficult.[29] We also chose not to include medical school strength as we did not have a standardized way of determining this.

We measured residency performance in several ways. First, we included a multisource assessment that residents receive at the end of a yearlong ambulatory long block[27,28] that spans parts of their second and third years of residency. This assessment contains quantitative and narrative feedback from attending physicians, peers, nurses, and allied health professionals in the ambulatory practice. In the long block 360-degree ratings, each resident received approximately 50 global ratings per half-year in the domains of patient care, teamwork, professionalism, and efficiency, and these scores were averaged to produce a composite measure of overall performance and class ranking. All raters used the same anonymous reporting system, with each category ranging from 1 (poor) to 5 (superior). We made no accounting for the relative contribution of assessment volume each rater delivered for a given resident. Second, we included a minimum of 25 direct patient assessments of resident performance per resident during the ambulatory long block experience using the physician communication score subset of the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) ambulatory survey.[30] Patients assessed residents on 7 physician attributes (physician explains, physician listens, physician gives instructions, physician knows history, physician respects patient, physician is on time, and physician calls with results), using a 6-point scale (1, never, to 6, always) for each behavior. We also included the American College of Physician ITE scores and the American Board of Internal Medicine (ABIM) certification status on first attempt.

We used descriptive statistics, including means and medians, to summarize the data. For continuous outcomes, univariate linear regression models were used to determine the relationship between the outcome and other potential covariates. All covariates were considered for inclusion in the multivariable linear regression models and were removed by backward elimination using the stepwise method. Only the covariates that were significant at a P value of $< .10$ were included in the final models. For dichotomous outcomes, logistic regression models were developed using the same methods. All analyses

were performed using SAS 9.4 (SAS Institute Inc, Cary, NC).

The University of Cincinnati Institutional Review Board approved this study.

Results

Among 167 residents, 20 (12%) had an advanced degree, 9 (5%) had a UME award, and 23 (14%) had a failure in medical school. The mean USMLE score was 218.5 for Step 1 and 230.8 for Step 2 CK.

Table 1 shows the relationship between ERAS material (USMLE scores, advanced degrees, awards, research, presence of failures in medical school) and the long block 360-degree ratings. Although the univariate analysis demonstrated several associations, in the multivariate analysis, only USMLE Step 2 CK scores were significantly associated with all modes of the long block faculty/peer/staff multisource assessment ratings (higher scores were associated with higher ratings).

Table 2 shows the relationship between ERAS application materials and patient ratings. In the multivariate analysis, higher USMLE Step 2 CK scores and having an advanced degree were associated with all patient-derived ratings.

In table 3, the multivariate analysis shows that higher USMLE Step 1 scores were associated with higher ITE scores, but not ABIM pass rate, and higher USMLE Step 2 CK scores were associated with all testing measures. For every point increase in USMLE Step 2 CK scores, the odds of passing the ABIM increased by 6.9%.

Discussion

Our study shows that USMLE Step 2 CK performance correlates with test scores throughout residency and beyond, but is also associated with assessment of clinical competence from multiple perspectives during a yearlong ambulatory long block. USMLE Step 1 correlated only with ITE scores. Having an advanced degree was associated with higher patient communication scores, but none of the other measures, including UME awards or presence of research experience, were significant predictors of any outcome in the multivariate analysis.

Much of the current residency performance prediction literature compares information in application materials to clinical performance using faculty rating scales and/or standardized testing materials. We expanded on this by adding in non-faculty member ratings and patient evaluations derived from a unique yearlong ambulatory experience. Our data add to the growing body of literature suggesting that USMLE Step 2 CK may be a better predictor of resident performance.[22,24,31–34] Reasons for these findings may be secondary to USMLE Step 2 CK being more clinically relevant or closer in time to residency graduation and board examinations. Reasons for why having an advanced degree was associated with higher patient communication scores may include residents having more life experience, more maturity, and/or completion of a previous rigorous training program.

Despite evidence for USMLE Step 2 CK, USMLE Step 1 scores continue to be one of the highest cited factors used by many residency programs in selecting applicants for interviews, although the available evidence suggests residency programs may do better by giving more weight to USMLE Step 2 CK in the application process.[22,24,31–34]

A major limitation of our study was that it was completed at a single institution and all clinical performance was measured only from a unique IM residency ambulatory long block structure. In addition, the staff, peer, and allied health assessment tools used in our program did not have significant supportive validity evidence for use. We did not weight certain medical school application items, preferring a present/absent accounting (eg, a failure in medical school could have been something as small as a shelf examination, or as large as an entire year). Due to difficulty in direct comparison we did not include medical school strength or commonly reported ERAS materials such as class rank and clerkship grades in the analysis. The multisource evaluation was anonymous and we could not determine the amount of contribution of each type of rater for any given resident. Residents were ranked on application data prior to matching so there is selection bias in the sample. Finally, no patient level outcomes data were included, and, we did not analyze the rich content in the narratives that accompany all of this data.

Future research should seek to understand why USMLE Step 2 CK may be a better predictor of residency success, identify the best strategies for applicants and programs to use USMLE Step 2 CK in residency selection, and determine if the presence of advance degrees is associated with higher patient-derived communication scores in other settings and specialties.

Conclusion

We have found that USMLE Step 2 CK is the best predictor of IM residency performance with regard to standardized testing during and after residency, as well as clinical performance from multiple perspectives during a yearlong ambulatory long block continuity experience.

TABLE 1
Long Block 360 Degree Ratings

	Faculty, Peer, Staff Patient Care		Faculty, Peer, Staff Teamwork		Faculty, Peer, Staff Professionalism		Faculty, Peer, Staff Efficiency		Overall Long Block Score		Long Block Class Rank	
Univariate Analysis												
	Coefficient	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**
USMLE Step 1 score	-0.004	.036	0.002	.09	0.003	.023	0.002	.10	0.003	.035	-0.068	.012
USMLE Step 2 score	0.004	.001	0.003	.04	0.003	.009	0.004	.002	0.003	.004	-0.076	.008
Presence of advanced degree (eg, PhD, MPH)	0.057	.47	0.134	.11	0.057	.54	-0.008	.93	-0.019	.82	-0.672	.70
Undergraduate award (eg, AOA, Humanism in Medicine)	0.076	.49	-0.054	.65	-0.055	.67	0.047	.71	0.044	.68	-1.026	.41
Listing any research experience	0.153	.043	0.047	.56	0.154	.08	0.285	.001	0.186	.017	-1.925	.25
Listing greater than 5 research experiences	-0.135	.08	-0.112	.17	-0.129	.16	-0.050	.58	-0.067	.39	0.830	.62
Presence of any failure in medical school	-0.105	.17	-0.156	.05	-0.056	.53	-0.079	.36	-0.049	.54	2.633	.11
Multivariable Analysis												
	Coefficient	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**
USMLE Step 2 score	0.00323	.009	0.00278	.044	0.00309	.012	0.00418	.002	0.00345	.004	-0.07579	.008
Undergraduate award (eg, AOA, Humanism in Medicine)	0.07306	.043										
Listing any research experience							0.15036	.09				
Listing greater than 5 research experiences	0.06962	.07			-0.14445	.044						
R square	0.1151		0.0312		0.0815		0.0942		0.0724		0.0621	
Mean	4.24		4.26		4.31		4.14		4.19		11.84	
Range	2.83–4.76		3.13–4.85		1.96–4.83		2.54–4.76		3.19–4.69		1–24	

Abbreviations: USMLE, United States Medical Licensing Examination; AOA, Alpha Omega Alpha.

TABLE 2
Patient Ratings

	Physician Explains		Physician Listens		Physician Gives Instructions		Physician Knows History		Physician Respects Patient		Physician Is on Time		Physician Calls With Results	
Univariate Analysis														
	Coefficient	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**
USMLE Step 1 score	0.004	.26	0.004	.19	0.003	.29	0.004	.23	0.004	.26	0.004	.28	0.004	.26
USMLE Step 2 score	0.007	.031	0.008	.024	0.007	.029	0.008	.020	0.007	.035	0.007	.05	0.008	.024
Presence of advanced degree (eg, PhD, MPH)	0.408	.06	0.434	.049	0.441	.044	0.424	.056	0.426	.054	0.459	.042	0.478	.037
Undergraduate award (eg, AOA, Humanism in Medicine)	0.185	.50	0.136	.64	0.156	.58	0.165	.57	0.176	.54	0.173	.56	0.065	.83
Listing any research experience	0.101	.61	0.048	.82	0.019	.93	0.067	.75	0.012	.95	0.079	.70	0.052	.81
Listing greater than 5 research experiences	0.257	.19	0.205	.32	0.187	.36	0.251	.22	0.182	.37	0.231	.27	0.251	.24
Presence of any failure in medical school	-0.424	.026	-0.471	.017	-0.442	.024	-0.381	.06	-0.446	.024	-0.451	.025	-0.196	.34
Multivariable Analysis														
	Coefficient	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**	**Coefficient**	***P* Value**
USMLE Step 2 score	0.008	.018	0.008	.013	0.008	.016	0.009	.011	0.008	.020	0.007	.029	0.009	.013
Presence of advanced degree (eg, PhD, MPH)	0.441	.037	0.468	.033	0.470	.029	0.457	.039	0.451	.041	0.472	.033	0.534	.022
R square	0.0771		0.0828		0.0817		0.0829		0.0742		0.0721		0.0879	
Mean	5.32		5.37		5.37		5.24		5.42		5.33		4.94	
Range	3.52–6.00		3.52–6.00		3.50–6.00		3.32–6.00		3.54–6.00		3.31–6.00		2.71–6.00	

Abbreviations: USMLE, United States Medical Licensing Examination; AOA, Alpha Omega Alpha.

TABLE 3
Test Scores

Univariate Analysis								
	ITE 1		ITE 2		ITE 3		Pass ABIM	
	Coefficient	*P* Value	Coefficient	*P* Value	Coefficient	*P* Value	Odds Ratio	*P* Value
USMLE Step 1 score	0.759	< .0001	0.809	< .0001	0.765	< .0001	1.033	.021
USMLE Step 2 score	0.941	< .0001	0.977	< .0001	0.828	< .0001	1.069	.001
Presence of advanced degree (eg, PhD, MPH)	-2.950	.66	-10.838	.12	-15.722	.05	0.744	.72
Undergraduate award (eg, AOA, Humanism in Medicine)	20.063	.033	20.939	.031	24.008	.021	0.812	.85
Listing any research experience	5.091	.44	2.304	.72	6.883	.36	1.250	.78
Listing greater than 5 research experiences	4.421	.51	-3.200	.65	1.276	.88	1.857	.56
Presence of any failure in medical school	-13.221	.036	-17.224	.009	-12.500	.10	0.333	.09
Multivariable Analysis								
	Coefficient	*P* Value	Coefficient	*P* Value	Coefficient	*P* Value	Odds Ratio	*P* Value
USMLE Step 1 score	0.240	.020	0.271	.008	0.332	.023		
USMLE Step 2 score	0.712	< .0001	0.722	< .0001	0.524	.001	1.069	.001
R square	0.5474		0.5716		0.389			
C statistic							0.821	

Abbreviations: ITE, in-training examination; ABIM, American Board of Internal Medicine; USMLE, United States Medical Licensing Examination; AOA, Alpha Omega Alpha.

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