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# Postgraduate and career: Clinical competence

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# **POSTGRADUATE AND CAREER**

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CLINICAL COMPETENCE

**CLASS RANKING MODELS FOR DEANS' LETTERS AND THEIR  
PSYCHOMETRIC EVALUATION**

*Robert S. Blacklow, Carla E. Goepf, Mohammadreza Hojat*

The dean's letter of evaluation written on behalf of graduating medical students is considered an important document in evaluating applicants to postgraduate residency programs. A recurrent complaint of those who must interpret deans' letters is that too often it is impossible to estimate how a candidate performed in comparison with his or her peers. One approach to providing such comparative information is to report the class rank in the body of the letter.

Despite the importance of comparative performance information, no serious attention has been directed towards developing a model to incorporate performance data in basic science as well as clinical science components of medical education in determining the class rank and to relate this to actual performance as a resident. The purpose of the present study was to develop class ranking models in which performance data from both basic and clinical sciences could be used and to study the predictive validity of the models.

The total study sample consisted of 1,283 graduates from Jefferson Medical College between 1986 and 1991. Five models were developed in determining the class rank. Different weights for basic and clinical science performance measures were employed in each model. Performance data from the first and second years (basic sciences component of medical education) and the third year (clinical sciences) were utilized in each model. Average ratings on each of three areas of postgraduate competence—data gathering and processing skills, interpersonal skills, and the socioeconomic aspects of patient care—were used as criterion measures for the validity study.

Validity of the models was studied by examining the true-positive and true-negative rates based on distribution of ranking models and ratings on the postgraduate competence areas. In this approach, for each ranking model, the top 25% and bottom 25% of the graduates were chosen. Also, the top and bottom 25% of the graduates, based on the distribution of each postgraduate competence area, were chosen. A model in which a weight of one-third was assigned to basic science grades and a weight of two-thirds to the clinical ratings in medical school showed more satisfactory true-positive and true-negative rates. This model represented a more acceptable balance between weights assigned to performance measures in basic and clinical sciences.

*Academic Medicine. 1991; 66(Supplement): S10-S12.*

*Also in Proceedings of the Thirtieth Annual Conference on Research in Medical Education, Washington, DC, November 1991.*

**FURTHER PSYCHOMETRIC EVALUATIONS OF A CLASS RANKING  
MODEL AS A PREDICTOR OF GRADUATES' CLINICAL COMPETENCE  
IN THE FIRST YEAR OF RESIDENCY**

*Robert S. Blacklow, Carla E. Goepf, Mohammadreza Hojat*

This study was designed to investigate further the psychometrics of a class-ranking model in which a weight of one-third was assigned to performance measures in basic sciences and a weight of two-thirds to ratings on six core clerkships. The first part of the study involved 215 graduates of Jefferson Medical College who, based on the ranking model, had been in the top and bottom quarters of the classes of 1991 and 1992. Six faculty, who did not know the graduates' ranks but were familiar with their performances and characteristics, were asked to judge the graduates' potentials to become competent physicians. The graduates' ranks according to the model were then compared with the ratings they received from the faculty. The second part of the study investigated whether there was a linear relationship between class ranks and ratings of postgraduate competence, by using directors' ratings of the data-gathering skills of 598 graduates (1986-1990) at the end of their first year of residency. A concordance rate of 85% was obtained between the graduates' ranks and the ratings they received from the medical school faculty, which supports the criterion-related validity of the ranking model. In addition, class ranks were linearly related to ratings of postgraduate competence. However, women and graduates who had been low achievers in medical school were less likely to have given permission for collecting postgraduate ratings, which led to range restriction and a possible under-estimation of the validity of the model. The psychometric evidence supports the class-ranking model, but other schools should exercise caution in employing the model until they accumulate evidence from data obtained from their own students.

*Academic Medicine. 1993; 68: 295-297.*

**RELATIONSHIP BETWEEN PERFORMANCE IN MEDICAL SCHOOL  
AND POSTGRADUATE COMPETENCE**

*Joseph S. Gonnella, Mohammadreza Hojat*

A sample of 441 graduates (between 1971 and 1981) of Jefferson Medical College who pursued their medical training in internal medicine, pediatrics, and obstetrics/gynecology was selected. It was hypothesized that the relationship between measures of academic achievement in medical school and measures of postgraduate performance would vary in different specialty programs. The hypothesis was confirmed by comparing graduates in the three specialties on grades in medical school, scores on the examinations of the National Board of Medical Examiners, and ratings in four areas of competence in the first postgraduate year (that is, medical knowledge, data-gathering skills, clinical judgment, and professional attitudes). It was also hypothesized that the strength of the relationship would vary at different levels of performance within the specialty programs. This was confirmed for some of the variables. The results indicated that inappropriate conclusions may be drawn about the relationship between performance before and after graduation from medical school if specialty differences and levels of performance are ignored.

*Journal of Medical Education. 1983; 58: 697-685.*

## THE ROLE OF RESIDENT PERFORMANCE EVALUATION IN BOARD CERTIFICATION

*Joseph S. Gonnella, Mohammadreza Hojat, James B. Erdmann, J. Jon Veloski*

The essence of graduate medical education involves mentoring, which implies continuous evaluation of a resident's performance accompanied by constructive feedback to enhance its development. The process should begin early in the program with a diagnostic assessment of the relevant competencies followed-up by an educational plan leading to the desired outcome. The fact that residents and fellows are committed to three or more years of graduate medical education in the same organization presents a unique opportunity for program leaders to evaluate performance systematically. The number of years that residents spend in the same program, unlike the weeks that medical students spend rotating among multiple departments, enables more thorough evaluation of residents together with remedial work when necessary.

Evaluation criteria for resident performance must be clearly defined and embraced by the specialty boards and the programs to support formative and summative evaluations. A competent physician fills a triad of roles. An acceptable evaluation must assess the resident's performance in each of three capacities: clinician, patient education, and manager of resources. Not only is it essential that each resident leave the program with the required clinical skills, but it is also important that the resident be able to communicate effectively with patients to clarify their medical programs, develop a management plan devised to improve their health, and achieve the expected outcomes of their care, including any risks. Lately, it has become even more important that the resident also acquire business and managerial skills to use resources efficiently and to understand the economic constraints facing medicine. A model for specifying the competencies of clinician, patient educator and resource manager is proposed.

Certain factors that affect healthcare outcomes but fall outside of the physician's direct control also need to be understood and considered when evaluating performance. These include the contributions of other members of the healthcare team, the availability of technology in different settings, the capacity of the patient and family to collaborate in the care plan, and constraints imposed by insurance coverage or government regulation. A thorough and accurate evaluation of a resident's performance must take these factors into account.

From a methodical perspective, some tightening of the rationale for determining acceptable performance standards is also recommended. Most programs and boards have defensible standards for deciding if a specific competency has been achieved. What may be questioned, however, are evaluation schemes that permit above average performance in one essential competency to offset less than adequate performance in another essential area, with the result that overall performance is judged acceptable.

*Mancall, E.L. and Bashook, P.G. (editors) Evaluating Residents for Board Certification. (pp.3-14) Chicago, IL: American Board of Medical Specialties, 1998.*

**A CASE OF MISTAKEN IDENTITY: SIGNAL AND NOISE  
IN CONNECTING PERFORMANCE ASSESSMENTS BEFORE AND  
AFTER GRADUATION FROM MEDICAL SCHOOL**

*Joseph S. Gonnella, Mohammadreza Hojat, James B. Erdmann, J. Jon Veloski*

The authors examine the assumption that there is continuity from one level of training to another in structured and purposeful professional education. Thus, more advanced levels of training are built upon the foundations laid in the preceding levels. While the connection between performance before and performance after graduation from medical school is theoretically rational, such a connection has not been well documented in empirical studies. The issue has been debated but has not been settled because relevant findings are inconsistent. It is argued that these inconsistencies can stem from contaminating factors and the conceptual and methodological limitations of empirical studies. Such limitations are described in terms of “noise” that obscures the maximal value of a true relationship (the “signal”). Contaminating factors such as the time interval between testings; institutional factors; specialty choices; conceptual dissimilarities between performance measures in medical school and in practice; methodological limitations such as the shapes of rating distributions, nonlinearity, heteroscedasticity, restriction of range, multicollinearity, voluntary participation, psychometrics of assessment instruments and differing methods of assessments; and a lack of assessments of personal qualities can produce “noise” that inhibits the strength of the “signal.” While suggesting solutions for extricating some of the tangled web of methodological and conceptual issues, the authors feel that solutions do not exist for all of the problems. They conclude that researchers should be aware of the limitations if they are to avoid underestimating the “signal,” which may fade because of background “noise.”

*Academic Medicine. 1993; 68(Supplement): S9-S16.*

## WHAT HAVE WE LEARNED AND WHERE DO WE GO FROM HERE?

*Joseph S. Gonnella, Mohammadreza Hojat, James B. Erdmann, J. Jon Veloski*

Longitudinal data from five medical schools—Jefferson Medical College, Medical College of Georgia, Southern Illinois University, University of Missouri at Kansas City, and Wright State University—were combined in a meta analytic study to investigate the global associations between performance measures in medical schools and clinical competence in residency. The total number of physicians from the five schools was 858, and top and bottom scorers in medical schools were divided into top and bottom groups based on their clinical competence ratings given by the directors of residency programs. It was found that 75% of high achievers in medical school were also rated high in clinical competence in their first year of residency. Of the low achievers in medical school, 61% were also rated low in their residency. The sensitivity and specificity of the combined data from the five medical schools were .74 and .63, respectively. An effect size of .36 was obtained. The results supported the proposition that associations between assessment measure during medical school and ratings of clinical competence in residency exist to a significant degree. Important factors in determining physician's competence were discussed and suggestions were made for future studies concerning performance measures in medical school and their connections to clinical competence beyond medical school.

*Academic Medicine. 1993; 68(Supplement): S79-S87.*

*Also in Gonnella, J.S., Hojat, M., Erdmann, J.B., & Veloski, J.J. (Eds.). Assessment measures in medical school, residency and practice: The connections. (chapter 15, pp.155-173) New York: Springer, 1993.*

**MEASURING THE CONTRIBUTION OF MEDICAL EDUCATION  
TO PATIENT CARE: A REVIEW**

*Joseph S. Gonnella, Mohammadreza Hojat, J. Jon Veloski, Carter Zeleznik*

This invited review describes the specific contribution that medical education makes to patient care. Although most studies conducted over the past 30 years have reported that the link between the education of physicians and their professional competence is negligible, limitations in those analyses require investigation. More recent empirical evidence from studies in which the Jefferson longitudinal database was used has indicated that a positive link exists between the levels at which medical students perform and the levels of competence at which they perform as physicians. This link is most evident when observations of the competence levels are made shortly after completing medical school. The reviewers found that many factors affect the ability to demonstrate the relationship between education and professional performance and these factors must be considered when research is undertaken.

*Proceedings of the Twenty-second Annual Conference on Research in Medical Education, Washington, DC, November 1983; 3-16.*

**SOCIAL RESPONSIBILITIES OF MEDICAL SCHOOLS**

*Joseph S. Gonnella, J. Jon Veloski, Gang Xu, Mohammadreza Hojat*

The outcomes produced by academic medical centers are exceedingly complex, difficult to define objectively, and almost limitless in number. Nevertheless, society and the profession look to medical schools to produce certain results within each of the three general categories of education, research, and patient care. In the present analysis, we will review some of these expectations.

Three challenges will be addressed. First will be the decision about which outcomes should be assessed. Second are the processes and many functions of medical education, such as the professional development of the faculty, that need to be considered when outcomes are analyzed. Third, the issue of the interrelationships among the various outcomes will be addressed. This paper will conclude with a case study using representative data to describe some of the educational outcomes of one medical college over the past three decades.

*Educacao Medica. 1994; 5: 86-97.*

**VALIDITY AND IMPORTANCE OF LOW RATINGS GIVEN TO MEDICAL SCHOOL GRADUATES IN NONCOGNITIVE AREAS**

*Mary W. Herman, J. Jon Veloski, Mohammadreza Hojat*

This study showed that the clinical ratings of noncognitive aspects of professional competence are generally valid. The ratings of 672 residents who graduated from Jefferson between 1978 and 1981, representing 76 percent of all graduates in that period, were analyzed. The ratings were made by chiefs of service, directors of medical education or physicians who had the opportunity to closely observe the graduates in their residency setting. The study comprised ratings from 203 hospitals in the United States. Ten items on the rating form were identified as noncognitive, i.e., items dealing with attitudes and the ability to apply acquired knowledge. Overall, only 3 percent of the residents received low ratings on these items, and 40 percent of those received high ratings on at least two items. The validity of the ratings is tested by relating them to the willingness of residency supervisors to offer further postgraduate training to the graduate being evaluated and to the clinical ratings received in the third year of medical school. Substantial relationships are shown between the offers of further training and those ratings.

*Journal of Medical Education. 1983; 58: 837-843.*

**COGNITIVE AND NONCOGNITIVE FACTORS IN PREDICTING THE CLINICAL PERFORMANCE OF MEDICAL SCHOOL GRADUATES**

*Mohammadreza Hojat, Bette D. Borenstein, J. Jon Veloski*

It is widely believed that both cognitive factors (knowledge, skills, and technical abilities) and noncognitive factors (interpersonal skills, attitudes, and personal qualities) contribute to a physician's competence. With concerns about medical costs being expressed by health professionals, insurance carriers, and public media and with the increased awareness of the psychosocial aspects of good health, the noncognitive elements of medical care deserve the serious attention of healthcare evaluators.

The present study was designed to investigate which of these three components of competence (cognitive, noncognitive, or socioeconomic aspects of patient care) contributes most significantly to predicting the performance of residents on an examination of patient management skills (Part III of the National Board Examinations) and to predicting an offer of further residency training by program supervisors. Data were collected on 609 first-year residents who graduated from Jefferson Medical College from 1980 through 1983 and for whom data on postgraduate rating forms were available. The postgraduate rating form consisted of 33 statements that dealt with three aspects of clinical competence: data-gathering and processing skills, interpersonal skills and attitudes, and socioeconomic aspects of patient care. An additional question on the form asked whether the supervisor would be willing to offer further training to the graduate.

The correlations between the Part III examination scores and the scores on factors 1 (data-gathering and processing skills), factor 2 (interpersonal skills and attitudes), and factor 3 (socioeconomic aspects of patient care) were .18 ( $p < .01$ ), .00, and .15 ( $p < .01$ ), respectively. Corresponding correlations between being offered further residency training and the three factors were .24 ( $p < .01$ ), .37 ( $p < .01$ ), and .04, respectively.

Despite the emphasis that has been placed on the cognitive dimensions of clinical competence, the present findings that the noncognitive factor yielded a higher correlation than the cognitive factor with an offer of further residency training indicates that the noncognitive factor was a better predictor than the cognitive. This finding was further supported by obtaining a larger regression weight for the noncognitive factor than the cognitive factor in the multivariate model. The cognitive factor, however, was a statistically significant predictor of the graduates' performance on the Part III examination, which evaluates patient management skills.

*Journal of Medical Education. 1988; 63: 323-325.*

**IS THE GLASS HALF FULL OR HALF EMPTY? A REEXAMINATION OF THE ASSOCIATIONS BETWEEN ASSESSMENT MEASURES DURING MEDICAL SCHOOL AND CLINICAL COMPETENCE AFTER GRADUATION**

*Mohammadreza Hojat, Joseph S. Gonnella, J. Jon Veloski, James B. Erdmann*

The purpose of this study was to investigate the associations between performances during medical school and in the first year of residency. It was hypothesized that the strength of such associations is a function of several variables, including similarities of the measured concepts, the formats of the assessments, the time interval between the assessments, performance levels, and specialty areas. The total sample consisted of 2,368 graduates of Jefferson Medical College between 1980 and 1990. The performance measures in medical school were grades on objective examinations in basic and clinical sciences, global ratings of clinical competence in junior core clerkships, and scores on the Part I and Part II examinations of the National Board of Medical Examiners (NBME). The postgraduate performance measures were scores on the Part III NBME examination, postgraduate competence ratings, and board certification. The ratings of postgraduate clinical competence (available for 73% of graduates) were made by residency directors at the end of the first year of residency in the areas of data-gathering and processing skills, interpersonal skills and attitudes, and socioeconomic aspects of patient care. Results supported the research hypotheses. It was found that the associations varied for difference measures, at different levels of performance, and in different specialties. The authors conclude that the glass is "half full" regarding the associations between assessment measures before and after graduation from medical school.

*Academic Medicine, 1993; 68(Supplement) S69-S76.*

*Also in Gonnella, J.S., Hojat, M., Erdmann, J.B., & Veloski, J.J. (Eds.). Assessment measures in medical school, residency and practice: The connections. (chapter 14, pp.137-152) New York: Springer, 1993.*

**COMPONENTS OF CLINICAL COMPETENCE RATINGS OF PHYSICIANS:  
AN EMPIRICAL APPROACH**

*Mohammadreza Hojat, J. Jon Veloski, Bette D. Borenstein*

The study investigated the underlying structure of ratings of clinical competence. The study sample was comprised of 609 physicians graduating from Jefferson Medical College between 1980 and 1983. The rating instrument consisted of 33 statements on clinical behavior in Likert-type format filled out by directors of medical education programs at postgraduate training institutions. The data were subjected to factor analysis. Three factors emerged involving “data-gathering and processing skills,” “interpersonal and attitudinal,” and “socioeconomic” dimensions. Correlations of factor scores with independent measures of conceptually related and unrelated constructs supported the appropriateness of the assigned factor titles. It was concluded that ratings of clinical competence represent a multidimensional construct involving at least three dimensions.

*Educational and Psychological Measurement. 1986; 46: 761-769.*

**CONCEPTUALIZATION AND MEASUREMENT OF CLINICAL COMPETENCE  
OF RESIDENTS: A BRIEF RATING FORM AND ITS  
PSYCHOMETRIC PROPERTIES**

*Thomas J. Nasca, Joseph S. Gonnella, Mohammadreza Hojat, J. Jon Veloski, James B. Erdmann,  
Mary R. Robeson, Timothy P. Brigham, Clara A. Callahan*

Conceptualization and measurement of clinical competence of residents are of interest to medical educators. Yet there is a scarcity of operational tools with satisfactory psychometric support for measuring clinical competence. In this study, we investigated the underlying structure, criterion-related validity and alpha reliability of a brief rating form (20 items) developed to assess clinical competence of residents. The study sample consisted of 882 physicians (654 men, 228 women) in postgraduate training at Thomas Jefferson University Hospital between 1998 and 2000. Construct validity of the form was supported by factor analysis. Two relevant factors emerged: 'Knowledge, Data-Gathering and Processing Skills', and 'Interpersonal Skills and Attitudes'. Criterion-related validity was supported by significant linear associates between factor scores and performance on the medical licensing examinations. Alpha reliability coefficients for the two factors were 0.98 and 0.97, respectively. This brief rating form can be employed as one measure to evaluate clinical competence of residents with reasonable confidence in its measurement properties.

*Medical Teacher. 2002; 24(3): 299-303.*

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**RELATIONSHIPS BETWEEN PERFORMANCE IN MEDICAL SCHOOL AND  
FIRST POSTGRADUATE YEAR**

*J. Jon Veloski, Mary W. Herman, Joseph S. Gonnella, Carter Zeleznik, William F. Kellow*

Changes in medical education have been recommended from both within and without the medical profession because of a growing dissatisfaction with the healthcare system and with the performance of physicians. These recommendations have included modifications of the medical school admissions process, the medical curriculum, and the evaluation of prospective medical students.

Data from a longitudinal study of Jefferson Medical College graduates were analyzed to determine levels of clinical competence in the first postgraduate year and the relationships between postgraduate ratings and performance during medical school. Ratings were obtained on knowledge, data-gathering skills, clinical judgment, and professional attitudes from the hospitals in which the graduates were receiving their first year's postgraduate training. Significant relationships were found among three levels of performance in medical school and postgraduate ratings in all four competence areas. Relationships were strongest at the highest and lowest performance levels. It was concluded that, in a substantial number of cases, performance in the first postgraduate year could be predicted on the basis of information available to the medical school faculty. It was also concluded that such a monitoring program could provide medical schools with valuable information and clues to possible weaknesses in their educational programs.

*Journal of Medical Education. 1979; 54: 909-916.*

**A VALIDITY STUDY OF PART III OF THE NATIONAL BOARD EXAMINATION**

*J. Jon Veloski, Mohammadreza Hojat, Joseph S. Gonnella*

The purpose of this study was to investigate the validity of Part III of the National Board Examination, a certifying examination of medical knowledge and patient management abilities. The subjects were 1,866 first-year resident physicians who graduated from Jefferson Medical College between 1970 and 1984. Statistically significant correlations were found between scores on this examination on the one hand and measures of basic and clinical sciences in medical school and Parts I and II of the National Board Examination on the other hand. Also, graduates who were rated high on supervisors' ratings of clinical competence areas in residency obtained higher scores on the examination than those rated low on this scale even when their baseline knowledge (scores on Part II) was controlled by employing analysis of covariance. In addition, assumptions were made that graduates who were offered further residency training and those who pursued broader, less-specialized careers would score higher on this examination. Both assumptions were confirmed. This 15-year study not only provides unique information about the validity of one certifying examination, but it also presents a model that might be used to evaluate other certification tests. Improvements in validity produced by new testing methods, such as computerized administration, could be put into perspective by using similar validity studies.

*Evaluation and the Health Professions. 1990; 13: 227-240.*

*Also in Proceedings of the Twenty-sixth Annual Conference on Research in Medical Education, Washington, DC, November 1987; 54-59.*