Medical School Performance of Initially Rejected Students

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At the University of Texas Medical School at Houston we had a unique opportunity to examine performance through the medical curriculum and one year of postgraduate training of 50 students initially rejected for medical school. Each had been interviewed by the same Admissions Committee, which earlier had selected 150 students through the traditional process. In contrasting the initially accepted and initially rejected groups, academic and demographic variables accounted for only 28% of group difference. The 72% of group difference not accounted for by the variables examined was presumed to relate to Admissions Committee preference. In attrition and in both preclinical and clinical performance through medical school and one year of postgraduate training, there were no meaningful differences between the groups. The observations suggest that the traditional interview process probably does not enhance the ability to predict performance of medical school applicants.

(*JAMA* 1987;257:47-51)

THE PROCESS of selection among applicants to medical school remains a topic of debate.[1-3] There are no generally accepted criteria for identification of the "good physician," nor are there valid predictors of effective performance.[4-15] It is therefore difficult to identify optimal candidates for the study of medicine. One of the few areas of consensus is that medical school faculty should take an active and extensive role in the selection of students. Faculty interview of applicants with final choice of acceptable students by an Admissions Committee is standard procedure in most schools.

The University of Texas Medical School at Houston (UTMSH) had a unique opportunity to investigate the validity of the traditional admissions process. In April 1979, the state legislature required that the class size of 150 be increased to 200 first-year students in September 1979. Permission for expansion was granted by the Liaison Committee on Medical Education. The Admissions Committee therefore was asked in mid-May to select an additional 50 students from those applicants who were previously interviewed but not chosen. Of the cohort thus selected, 43 (86%) had not been accepted by any medical school as of May 1.

In comparing 50 students initially rejected by an admissions committee with 150 classmates previously deemed acceptable by the same committee, two basic questions were addressed: (1) Were there academic or demographic variables that determined membership in initially accepted (IA) or initially rejected (IR) groupings? (2) Were there differences in attrition or in performance between the groups in their basic science courses, clinical clerkships, or first year of postgraduate education?

BACKGROUND
Admissions Process

The University of Texas System has four medical schools that share a central application office but individually set criteria for acceptance of students. Each school is expected to accept at least 90% of its student body from in-state residents. An applicant may apply to one or to any combination of the four schools with a single application. The majority of in-state candidates apply to all four schools. There are approximately 2300 Texas residents in the total applicant pool each year.

Each school independently selects its candidates for interview and subsequently rates them against its own criteria. At UTMSH, as in the other three University of Texas schools, the admissions process has two steps. The first step is review of all applications by an assistant dean for admissions, who screens for likelihood of academic success. Such screening largely centers on academic performance and also takes into account preprofessional adviser assessments and extracurricular or work-related activity that may have impacted on academic achievement. The second step is interview of those candidates who meet the screening criteria.

From the approximately 2200 appli-

cants to UTMSH in 1978, 800 (36%) were invited for interview. Each was interviewed by one member of the Admissions Committee and by one other faculty member. No attempt was made to standardize the interviews or to weigh the objective and subjective variables considered by the interviewers. Each interviewer submitted to the Admissions Committee a written assessment of the applicant.

The candidate was discussed by the total committee when it had examined the reports of the interviewers, the preprofessional adviser evaluations, and the academic record. In the committee meeting each member rated the applicant on a nonstandardized scale from 0 (unacceptable) to 7 (excellent). The committee rating was the average of the individual ratings.

At the end of the interviewing season, ratings were converted to a rank-order list submitted to the central application office. Interviewed applicants thus were not "accepted" nor "rejected" by committee vote. Each was simply ranked on a spectrum from highly desirable to undesirable. Institutional ranking of applicants and student ranking of schools by which they had been interviewed were computer matched for mutually highest choice.

The 150 students initially matched by UTMSH were drawn from the top 350 in institutional ranking. Between mid-February and mid-April, six of the 150 withdrew and were replaced, so that 144 of the original cohort remained at the time of matriculation. Each of the six students selected as replacements ranked higher than 575 in the rank-order preference of the Admissions Committee.

When UTMSH was required in mid-May to choose an additional 50 students, the available pool of recruitable students was found to have been ranked between 700 and 800 by the committee. Forty-three (86%) of the 50 had not been accepted by any medical school.

All 200 students matriculated in September 1979. The associate dean for student affairs had the only list that made it possible to identify the groups.

Curriculum

The UTMSH has a four-year curriculum with 22 courses over a two-year period comprising the preclinical portion. Students are required to take part I of the National Board examination at the conclusion of the basic science courses. In the third year, each student spends 12 weeks each in internal medicine and surgery and eight weeks each in pediatrics, psychiatry, and obstetrics/gynecology. Four-week clerkships

in family medicine and neurology are required of fourth-year students. The fourth year is otherwise elective.

Grading

Grading through the total curriculum is on an "honors/pass/fail" system. Grading in preclinical courses is based largely on written test performance. Grading in the clinical rotations is more subjective. Attending physicians and residents evaluate clinical students in five descriptive categories: knowledge and understanding, clinical skills, work habits and attitudes, problem solving and judgment, and interpersonal skills. Each clerkship has a written final examination, so that the clerkship grade represents a combination of subjective and objective assessments. The weighting of each varies among departments.

METHODS
Assignment to Groups

The IA group was composed of those 144 students who remained of the 150 candidates initially chosen by February and ranked between 1 and 350 in committee preference. The IR group consisted of the 56 students selected after February. Six of this group ranked between 350 and 575 and 50 ranked between 700 and 795 of the 800 candidates interviewed.

Data base

Academic, demographic, and preferential rating data were recorded for each student from review of application files. The initial data base characterizing both IA and IR groupings is detailed in Table 1.

Students in either group who withdrew from school, took extended leaves of absence, or failed to meet the academic requirements to progress to the next level with the rest of the class were excluded from appropriate analyses of performance.

Analyses

Methods of analysis and variables examined are summarized in Table 2. In all analyses the .05 level of probability was accepted as significant. As detailed in Table 2, initial analyses explored differences between IA and IR cohorts in characteristics and in performance. Further analysis compared the 50 highest-ranked IA students with the 50 IR students to eliminate possible "damping" effect by students in the midrange of preference. Final analyses examined the UTMSH class against other classes in the University of Texas system to see if they reflected the same population.

Differences in Group Characteristics.—Analyses were used to deter-

Table 1.—Data base for Entering Class, 1979

Academic variables
  Undergraduate grade point average
  Undergraduate science grade point average
  Total MCAT scores
  Six MCAT subscores
Demographic variables
  Age
  Gender
  Ethnicity
  Residence
Preference variables
  Preprofessional adviser evaluation
  Interviewer rating
  Committee rating
Psychological profile
  Myers Briggs
  Allport-Vernon-Lindzey
  Edwards Personal Profile

mine the extent to which academic and demographic variables were responsible for or predictive of group membership. In discriminant function analysis, group membership was the dependent variable and the independent variables were those academic, demographic, and preferential factors listed in Table 1. In a second analysis employing a general linear model analysis of variance/covariance (ANCOVA), the overall committee rating was used as the dependent variable because that was the single constant criterion that determined group membership.

The movement in appropriate sequence through the curriculum was noted for each group. Leaves of absence long enough to delay progression to the next level of training at the usual time, withdrawals, and dismissals for any reasons were tabulated for each group. Note was made of honors earned and courses failed in each year.

Performance Differences.—The performance of the cohorts through the preclinical, clinical, and postgraduate curricula was likewise examined first by discriminant function analysis and then by ANCOVA. Because of the honors/pass/fail grading system and highly subjective assessments in the clinical and postgraduate periods, it was necessary to convert performance evaluations to a numeric sequence for analysis.

In the preclinical arena, we obtained from faculty files a numeric average for each student in each of the 22 courses. These were factored separately and also as a cumulative average, with weighing of courses by credit hours. The cumulative average served as the major performance index for the basic science curriculum. Numbers of honors earned and courses failed were entered as additional variables for discriminant analysis.

In the clinical clerkships, each student was assessed by attending physicians and by residents in knowledge/understanding, clinical skills, work hab-

Table 2.—Analyses and Variables*

| Relationship IA/IR Groupings | Discriminant Function | | ANCOVA | | |
	Dependent Variable	Independent Variable	Dependent Variable	Controlled Variable	Covariants
Differences at matriculation	Membership in IA/IR cohort	Academic, demographic, and preferential variables in Table 1	Overall committee rating	Demographic variables in Table 1	Academic and remaining preferential variables in Table 1
Differences in performance					
Basic science	As above	As above, and average grades in 22 basic science courses + honors + failures	Average grades in basic science courses and cumulative average	As above	As above
Part I, NBME	As above	Table 1 variables + part I subscores + cumulative scores	Scores in part I, NBME	As above	As above
Clinical clerkships	As above	Average grade in each clerkship + cumulative average + honors + failures	Average grade in each clerkship and cumulative average	As above	As above
1st postgraduate year	As above	Academic and demographic + cumulative average in basic science + cumulative average in clerkships	Numeric ratings in 16 performance categories + average of ratings	As above	As above

*IA indicates initially accepted; IR, initially rejected; and ANCOVA, analysis of covariance.

Table 3.—Group Means for Variables Tested*

| | Student Group | |
	Initially Accepted	Initially Rejected
Academic variables		
GPA	3.48	3.40
Science GPA	3.40	3.33
Total MCAT score	55.20	52.60
Chemistry	8.74	8.41
Biology	9.38	9.07
Physics	9.10	8.59
Quantitative	9.35	8.71
Problem solving	9.21	8.73
Reading	9.45	9.14
Demographic variables		
Age, y	23.7	23.9
Gender, No. M/F	106/38	42/14
Ethnicity, No. nonminority/minority	135/9	55/1
Residence, No. Texas/other	135/9	53/3
Preferential variables (maximum score, 7.0)		
Preprofessional evaluation	6.16	5.74
Interviewer rating	5.27	4.66
Committee rating	5.47	4.58

*GPA indicates grade point average.

its/attitudes, problem solving/judgment, and interpersonal skills. A research assistant worked with each clerkship director to convert these five clinical ratings and the raw scores on NBME shelf examination or departmental final examination to equivalent numeric scores on a six-point scale from 0 (unacceptable) to 5 (outstanding). The cumulative grade for a clerkship was then the average of the five subjective scores plus the converted test score. A straight average of the five clerkship grades served as the major performance index for the third year. As in the preclinical curriculum, honors earned and clerkships failed were noted for discriminant analysis.

In May 1984, evaluation forms were mailed to program directors of the residencies that graduates had entered in July 1983. Directors were asked to rate each resident on a six-point scale (0 to 5) in each of 16 categories that represented an expansion of the characteristics in which they had been rated as clinical students.

Elimination of Damping Effect.— A second set of analyses sought differences in preclinical or clinical performance between the 50 IA students ranked highest by the Admissions Committee and the 50 IR students. The purpose was to ensure that performance differences between highly desirable students and IR students were not damped by students in the midrange of preferential ranking. We used ANCOVAs with the average of the preclinical grades and the composite average of the clerkship as the respective dependent variables. Controlled factors and covariates were identical to those shown in Table 2.

Comparison With Other Schools.— The overall mean grade point average (GPA) of 3.46 and MCAT mean score of 54.6 for the total UTMSH class were compared in a one-way analysis of variance with mean GPA and mean MCAT score for the 1979 entering classes of the University of Texas system and of the Baylor College of Medicine, Houston. In that year, the San Antonio school admitted 202 students, the Galveston school 203, and Southwestern at Dallas 208. The aggregate mean GPA for the three other medical schools in the University of Texas system was 3.57, and the mean MCAT score was 56.5. Baylor admitted 120 Texas residents with a mean GPA of 3.61 and a mean MCAT score of 58.5.

RESULTS
Group Differences

Differences at Matriculation.— Means for academic, demographic, and preferential variables of the IA cohort of 144 students and the IR group of 56 students are shown in Table 3. The most appreciable difference was the antici-pated disparity in mean committee rating, since this was the one criterion that determined cohort assignment in the selection process. The overall committee rating was highly correlated with the rating of the interviewer who had presented that student to the committee.

In discriminant analysis, MCAT total scores and preprofessional adviser ratings accounted for 32.5% of the difference between groups. When interviewer and committee ratings were inserted into the discriminant analysis, however, the influence of MCAT and preprofessional evaluation dropped to 12%.

A t test comparison of the same variables also showed significant differences between group means at the .05 level for influence of MCAT and preprofessional adviser evaluation. The differences were not considered meaningful, however, for the relatively lower means in the IR group were still within the range exhibited by members of the IA group.

By ANCOVA it was found that a maximum of 28% of intergroup difference was accounted for by academic variables, demographic factors, and evaluations by preprofessional advisors. The remaining 72% of the difference between IA and IR groups was in random factors that included interviewer and committee preference.

Progression Through Curriculum. —Two of the 144 IA students withdrew in their first quarter of medical school, and five others took leaves of absence or otherwise failed to progress through the basic science curriculum; thus, 137

(95%) of IA students completed the preclinical curriculum at the appropriate time. Of the 56 IR students, one withdrew in his first year and four did not complete the basic science courses on schedule; thus, 51 (91%) remained at the end of the first two years.

During the clinical years, two IA students withdrew and two others transferred to other schools. An additional six took leaves or did not graduate on schedule for other reasons. The 51 IR students who began the clinical curriculum were decreased by transfer of one student and dismissal from school of another. Thus, 127 (88%) of the 144 IA students graduated at the appropriate time and 49 (88%) of the 56 IR students graduated on schedule.

Viewed from another perspective, 176 (88%) of the 200 students who matriculated in 1979 graduated in 1983, and 18 (9%) graduated in 1984. The IA and IR students were proportionally represented in each group of graduates. Of the six students who withdrew or were dismissed from medical school, four were IA and two were IR.

Performance Differences

Comparison of Performance in Preclinical Curriculum.—On completion of the second year, the relative performance of the groups was examined by numeric scores for the 22 courses and in scores on part I of the NBME. Honors earned, courses failed, and failure to advance to the second year were noted. There were no appreciable differences on discriminant function analysis.

By ANCOVAs (Table 2), performance of IA and IR groups did not differ significantly. On regression analysis there did appear to be some relationship of gender to preclinical performance. Women tended to perform better both in the basic science courses and on part I of the NBME.

Comparison of Performance in Clinical Curriculum.—With the use of the cumulative score plus the six component scores derived for each rotation in discriminant function analysis and in ANCOVAs, the IA and IR cohorts were indistinguishable in their clinical performances. Of the 16 persons selected for Alpha Omega Alpha honor society, 12 (75%) were IA and four (25%) were IR students; this ratio was proportional to the IA/IR ratio in the class. As in the preclinical curriculum, women tended to outperform men.

Comparison of Performance in First Postgraduate Year.—Of the 176 class members who graduated in 1983, 175 entered residency programs. One hundred forty-one evaluation questionnaires were returned from program di-

rectors, for a yield of 81%. Analysis of the evaluations demonstrated neither meaningful nor significant differences between IA and IR groups in performance during the first year of residency.

Differences Between Top and Bottom Quartiles in Committee Ranking

Repetition of the above analyses compared the top 50 IA students in committee rating with the 50 IR students. There were no performance differences attributable to group membership. Thus, there appeared to be no midrange damping effect.

Comparison of UTMSH With Other Texas Schools

Analysis of variance using mean GPAs and MCAT scores as dependent variables was used to contrast the total class at UTMSH against the entering classes for the same year in the other University of Texas medical schools. In the total University of Texas system there were 2300 applications, from which 813 students were selected. Thus, 35.3% of applicants were accepted to medical school. The analysis of variance revealed no significant difference between the GPA and MCAT means for UTMSH and the other medical schools.

Comparison of UTMSH GPA and MCAT means against those same variables at the Baylor College of Medicine did show a significant difference at the .05 level, so that the latter group appeared to represent a different population even when it was adjusted to reflect only Texas applicants.

On the other hand, when the FLEX examination results were examined for 1983, the graduation year for the index class, there were no significant differences in scores between UTMSH, Baylor College of Medicine, and the other University of Texas medical schools.

COMMENT

In the state of Texas in 1979, 35% of medical school applicants were successful in their bid to begin medical education within the University of Texas system. The UTMSH accepted 150 first-year students who were statistically similar to their peers in the other University of Texas medical schools. It also enrolled 50 students who were significantly different in having lower GPA and MCAT scores. The applicability of the statistical differences between the UTMSH students and other groups is questionable, and the statistical differences between the IA and IR groups are likewise spurious since the mean for any one group was within the range of the others. Furthermore, any differences in populations appeared to be eradicated

through the four years of undergraduate medical education, since there were no performance differences between schools on the FLEX examination.

The important issue in this study is that there was a unique opportunity to examine the performance through the medical curriculum of a group of students who had lower GPAs and MCAT scores and who had been initially rejected by all medical schools to which they had applied. The contrast between the preferred and the nonpreferred groups allows a new perspective on the admissions process.

Analyses of the identifiable differences between the IA and IR medical students at UTMSH showed that objective variables such as GPAs and scores on MCAT accounted for only 28% of differences between groups. The remaining 72% of variance was presumed to relate to committee preference based on interview of applicants. Thus, approximately three fourths of the difference between IA and IR students may be accounted for by the subjective impression created in approximately two hours of interviewing.

Analyses of performance through the four years of the medical curriculum and the first postgraduate year indicated that the IA and IR groups did not differ in any meaningful fashion. Attrition rates, failure rates, and distribution of honors were proportionally represented in the cohorts.

Even when the top 50 students in committee preference were compared with the 50 IR applicants, there were no differences. Thus, the least desirable candidates performed as well or as poorly as did the most desirable. The only intragroup difference in the total class related to gender. The tendency of women to perform better academically than their male peers has been recognized by other investigators.[16,17]

Initial acceptance and initial rejection appear nonsignificant as predictors of performance. The initial screening by one individual who examines each applicant for academic and demographic variables, work experience, extracurricular activities, life experience, and assessment by preprofessional advisers appears to establish a valid cutoff point for acceptance. The applicant who survives this initial screening appears to have every reasonable chance to succeed in medical school. The superimposition of the interview process does not appear to enhance performance prediction for applicants.

If the interview does not have predictive value for successful performance, one must question whether the traditional process is cost-effective in select-

ing among applicants for medical school. This article does not address the direct costs to applicants for travel and lodging, the direct costs to institutions for staff and means, and the indirect costs in faculty man-hours spent in interviewing, preparing reports, and attending committee meetings. The expense obviously is a large one.

One might contend, on the other hand, that the interview process does serve at least a negative purpose in eliminating undesirable candidates such as the psychotic or extremely inflexible individual. The attrition rate for psychological reasons, however, makes one wonder if such a purpose really is served effectively in the initial interview.

A second, and more telling, argument

in favor of the traditional interview is that it serves in most schools as an effective recruiting device. Students at UTMSH were surveyed in 1979 to determine what influenced them to select the particular school. A majority stated that the positive effect of the interviewer(s) was of major importance in their decision. This may well be a good reason for retaining the traditional process. The interview, however, should be recognized and acknowledged as a recruiting tool rather than as a method for selection of students whose performance will guarantee success.

In summary, it appears that careful initial screening of medical school applications by a knowledgeable person who assesses the academic and demographic

variables, the work experience and extracurricular activities, and the evaluations of preprofessional advisers establishes a good likelihood for successful performance in medical school. The traditional interview process does not appear to enhance the predictive value of such initial screening. Should initial screening be followed by a lottery among the viable applicants?

References

1. Cuca JM, Sakakeeny LA, Johnson DG: *The Medical School Admissions Process: A Review of the Literature, 1955-1976.* Washington, DC, Association of American Medical Colleges, 1976.
2. Funkenstein DH: Current medical school admissions: The problems and a proposal. *J Med Educ* 1970;45:497-509.
3. Weingartner RH: Selecting for medical school. *J Med Educ* 1980;55:922-927.
4. Gough HG, Hall WB, Harris RE: Admissions procedures as forecasters of performance in medical training. *J Med Educ* 1963;38:983-998.
5. Gough HG: Non-intellectual factors in the selection and evaluation of medical students. *J Med Educ* 1967;42:642-650.
6. Gough HG: The recruitment and selection of medical students, in Coombs RM, Vincent CE (eds): *Psychological Aspects of Medical Training.*

Springfield, Ill, Charles C Thomas Publisher, 1971, pp 5-43.
7. Gough HG, Hall WB: The prediction of academic and clinical performance in medical school. *Research Higher Education* 1975;3:301-313.
8. Murden R, Galloway GM, Reid JC, et al: Academic and personal predictors of clinical success in medical school. *J Med Educ* 1978;53:711-719.
9. Kelly EL: A critique of the interview. *J Med Educ* 1957;32:78-84.
10. Gottheil E, Michael CE: Predictor variables employed in research on the selection of medical students. *J Med Educ* 1957;32:131-147.
11. Maguire FL: The new MCAT and medical student performance. *J Med Educ* 1980;55:405-408.
12. Maguire FL: The new MCAT and its relationship to medical student performance in year two. *J Med Educ* 1981;56:60-61.

13. Cullen TJ, Dohner CW, Peckham PD, et al: Predicting first-quarter test scores from the new Medical College Admission Test. *J Med Educ* 1980;55:393-398.
14. Brooks CM, Jackson JR, Hoffman HH, et al: Validity of the new MCAT for predicting GPA and NBME part I examination performance. *J Med Educ* 1981;56:767-769.
15. Walker JD, Killip DE, Fuller JL: The significance of the admission interview in predicting students' performance in dental school. *J Med Educ* 1986;60:569-571.
16. Weinberg E, Rooney JF: The academic performance of women students in medical school. *J Med Educ* 1973;48:240-247.
17. Roos NP, Gaumont M, Colwill NL: Female and physician: A role incongruity. *J Med Educ* 1970; 45:497-509.