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ABSTRACT

This document reviews the research on the medical school admissions process that has been completed during the past twenty years. The process is put into perspective by a historical overview chapter that traces trends in medical school admissions and highlights, where possible, relationships between the admissions process and institutional and national goals. In the second chapter, the logistics of the technical aspects of the process, and changes therein, are examined, especially where such changes have facilitated applications by heretofore underrepresented groups. The third chapter summarizes studies on the composition and functions of admissions committees. Selection factors, both cognitive and noncognitive, their measurement and their predictive validity are the subject of the fourth chapter. Included is a discussion of the trend toward predicting physician performance rather than solely medical school performance. The fifth chapter reviews the research devoted to the weighting, both implicit and explicit, of selection factors. Changes in the intellectual academic, personality (especially as tested by the Myers/Briggs Type Indicator), and demographic characteristics of accepted and rejected applicants are detailed in the final chapter. (Author)

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THE MEDICAL SCHOOL ADMISSIONS PROCESS

A REVIEW OF THE LITERATURE
1955 - 76

SPECIAL REPORT

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A REVIEW OF THE LITERATURE

1955-1976

SPECIAL REPORT

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ASSOCIATION OF AMERICAN MEDICAL COLLEGES

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TABLE OF CONTENTS

List of Tables v

List of Figures ix

Foreword xi

I. Historical Overview of National Trends In Medical School Admissions 1

World War II and the Early 1950's 1
1955 Through 1959 2
1960 Through 1964 3
1965 Through 1969 5
The 1970's 6

II. Logistics of the Application Process 11

Computerization of Application Process 11
Paperwork Processing 14
Timing of Application Process 17
Processing Costs and Information Dissemination 22
Recruitment Programs 23

III. Composition and Function of Admissions Committees 27

The Late 1950's 27
1960's 34
1970's 35
Summary 40

IV. Selection Factors and Their Predictive Validity 43

The Criterion Problem 43
Domains of Student Characteristics and Their Measures 46
Cognitive Selection Factors 48

The Medical College Admission Test (MCAT) 48
The MCAT and Medical School Performance 50

Medical School Performance Operationalized As Attrition or Progress 50
Medical School Performance Operationalized As Grades and Test Scores. 51
The MCAT and Physician Performance. 56
The MCAT and Other Considerations 59
A "New MCAT℠" 62
Premedical Grade Point Average (GPA) 64
GPA and Medical School Performance. 65
Medical School Performance Operationalized As Attrition or Progress 65
Medical School Performance Operationalized As Grades and Test Scores. 66
GPA and Physician Performance 68
GPA and Other Considerations. 69
Non-Cognitive Selection Factors 70
Biographic/Demographic Factors 70
Demographic Variables and Medical School Performance. .76
Demographic Variables and Physician Performance 77
Personality Traits and Interests 79
The Interview 81
Application Materials 91
Personality Tests 95
Structured Personality Tests and Medical School Performance 98
Structured Personality Tests and Physican Performance 106

V. Weighting of Selection Factors 109
Explicit Weighting. 110
Implicit Weighting. 119

VI. Changes in the Characteristics of Accepted and Rejected Applicants 127
Intellectual Characteristics and Academic Background. . . .127
Personality Characteristics 134

Demographic Characteristics 136

Socio-economic Background 136
Geographic Origins 137
Sex 140
Racial/Ethnic Identity 140
Age 145

Nonmatriculating and Unaccepted Students 145

Epilogue 149

Bibliography 151

LIST OF TABLES

Table 2.1 Application Trends for Classes Entering U.S. Medical Schools in 1955, 1965 and 1975 12

Table 2.2 Acceptance Procedures -- Traffic Rules (approved in 1954) 19

Table 2.3 Recommendations of the AAMC Concerning Medical School Acceptance Procedures (Revised September 1975) . . . 20

Table 3.1 Teaching Rank and Department of Admission Committee Members (Committee members group) 29

Table 3.2 Training and Present Position of Admission Committee Members (Participants group). 30

Table 3.3 Size of Admissions Committees as Related to Number of Applications Processed for 1956 Class 30

Table 3.4 Membership Rotation of Admissions Committees (Participants group). 31

Table 3.5 Distribution of Work According to Administrative Position (Participants group) 31

Table 3.6 Admissions Committee Operations 32

Table 3.7 Methods for Deciding Which Applicants Are Interviewed (Participants group; multiple response) 32

Table 3.8 Comments on Committee's Role in Developing Admissions Policy and Procedure (Participants group) 33

Table 3.9 Percentage of 853 Admissions Committee Members by Teaching Department and Administrative Position . . 37

Table 3.10 Teaching Department and Administrative Position of Admission Committee Members (Committee members group 38

Table 4.1	Mean Scores on Medical College Admission Test by Race, Sex, and Academic Progress of 1970 Entrants to U.S. Medical Schools	52
Table 4.2	Information Requested on Application Forms by Medical Schools	72
Table 4.2a	Information Requested on AMCAS Application But Not Listed in Table 4.2	73
Table 4.3	Committee Estimates of Value of Essay And/Or Autobiography in Appraising Applicants	74
Table 4.4	Opinion on Potential Advantage of Interview to School in Relation to Extent of Use of Interview	75
Table 4.5	Present Use of Various Sources of Information in Evaluating Nonintellectual Characteristics	80
Table 4.6	Percent of Questions in Each Category Asked by Each Interviewer	85
Table 4.7	Ranking of Variables Used by SMAE Participants in Admission Decision	88
Table 4.8	Agreement of SMAE Participants' Ratings and Assigned Ratings of Variables for Applicant Cases	89
Table 4.9	Committee Estimates of Value of Premedical Advisory Reports in Appraising Applicants	93
Table 4.10	Committee Estimates of Value of Essay And/Or Autobiography in Appraising Applicants	93
Table 4.11	Student Reports on Use of Psychological Tests Other than MCAT	96
Table 4.12	Sources of Information on Mental Health of Applicants	96
Table 4.13	Psychological Tests: Present and Planned Use in Evaluating Nonintellectual Characteristics	97
Table 4.14	Number of Schools Using Listed Standard Instruments	97

Table 5.1 School Policy on Factors Involved in Screening Applicants Seriously Considered for Admission . 111

Table 6.1 Mean MCAT Scores of Accepted and Rejected Applicants 130

Table 6.2 Comparative Analysis of College Records of First-Year Medical Students in Classes Entering 1955 Through 1974 132

Table 6.3 MCAT Scores and Undergraduate Grade Point Averages for 1975-76 Entering Class by Self Description . 133

Table 6.4 Number and Percent of State Residents Enrolled in First-Year Class by Public and Private Medical Schools 1969-1970 Through 1974-1975 139

Table 6.5 Women Applicants to U.S. Medical Schools for Selected Years From 1955-56 Through 1975-76 141

Table 6.6 Comparison of Minority Women First-Year Enrollments In U.S. Medical Schools, 1971-72 Versus 1975-76 . 142

Table 6.7 1975-76 Applicants by Racial/Ethnic Self Description 144

Table 6.8 Mean Age by Race, Sex and Matriculation Success of Applicants to the 1972 Entering Medical School Class 146

LIST OF FIGURES

Figure 2.1	The University of Texas Admission Matching System Flowchart Diagram that is Placed in Application Packets	18
Figure 4.1	Sources of Data on Applicant Characteristics . . .	47
Figure 5.1	Program in Medical Sciences. Programmed Information Management System - Selection Model	.116
Figure 5.2	AID Prediction Tree	.120
Figure 6.1	Acceptance Rates of Applicants by Age	.146

FOREWORD

The objective of this report is to provide a comprehensive review of that literature on the admissions process to U.S. medical schools which has been produced since 1955. Where information permits, the review includes a description of the relationship between the admissions process and the meeting of national and institutional goals (e.g., increased opportunities for minorities, women, and students from financially disadvantaged backgrounds).

Several trends relating to medical education and to the provision of medical care which became obvious in recent years have combined to focus interest on medical schools admissions. One of the major trends has been the phenomenal increase in applications for admission. Concurrent with the increased student interest in a medical career, there has developed a recognition of the need for increased representation in the physician pool of minorities, women, and persons from economically disadvantaged backgrounds. In addition, an earlier concern with preventing a threatened general shortage of physicians has been replaced by concerns over the distribution of specialties and practice locations.

In order to fully understand these issues and their relationship to the admissions process, one must examine them in the context of the entire admissions system. In addition, an historical perspective is helpful in understanding how these trends have evolved. The intention of this review, therefore, is to be as comprehensive as possible in examining all important aspects of the admissions process. The six major areas covered are: a) historical trends in the admissions process; b) the logistics of the application process; c) the composition and functions of admissions committees; d) the range of criteria for the selection of students; e) the weighting of selection criteria used in various medical schools; and f) changes in the characteristics of accepted and rejected applicants.

Besides providing a survey and synthesis of the efforts and research undertaken to improve the admissions process, this review was originally intended to have served as the groundwork for a quantitative analysis of the trends in, and the goals of, the admissions process, from both a national and an institutional perspective. However, an exhaustive search of the literature uncovered almost no systematic data, on either the national or the institutional level, on goals and very little institutional data on trends. This search involved scanning the catalogues of selected medical schools for the past twenty years in an effort to determine whether they contained any statements concerning their institutional goals. It was found that the only statements on this topic were of too vague and general a nature to be of use in the proposed quantitative analysis. In addition, a similar search was made of the Medical School Admissions Requirements handbooks for 1955 through 1976. This search also

failed to turn up adequate information for this type of analysis. Likewise, all other sources of information used in this literature review--the Journal of Medical Education, published and unpublished reports, etc.--were carefully examined. Again, no data were found which would permit a quantified analysis of the trends in goal modification for the admissions process from either a national or institutional basis.

It was felt, therefore, that rather than abandon entirely the analysis of institutional and national goals and trends, a single more insightful document would result by combining the literature review with a qualitative analysis of these variables in those areas where information would permit. Accordingly, the first chapter, an historical overview of the admissions process, was included to provide a national perspective on general trends against which institutional efforts could be compared. Implicit in these actual efforts are the unstated goals of the medical institutions.

The sources used in this literature review were located in several ways. Various published bibliographies (e.g., Nourse and Johnson, 1966; Schofield, 1972; Smith, 1972; D'Costa and Yancik, 1974; Mathews, 1975; and Floyd, 1976) provided an introduction to the literature. After considering several bibliographic computer systems, two proved fruitful: the Medical Literature Analysis and Retrieval System (MEDLARS); and the Educational Resources Information Center (ERIC).

Literature reviews on related subject matter provided numerous "leads" (e.g., McGuire, 1972; Applied Management Sciences, 1976; and Yett, 1976); and references were gleaned from the bibliographies of each individual source which we read.

An issue-by-issue search was made of volumes 30 through 51 of the Journal of Medical Education (which cover the years from 1955 to the present), and the AAMC's handbooks on Medical School Admissions Requirements and on Minority Student Opportunities in United States Medical Schools were carefully examined for relevant material. Catalogues for individual medical schools were not utilized since a trial run revealed that the relevant admissions information included in them almost always appeared in the Medical School Admissions Requirements handbooks.

Certain individuals identified as involved in related research at the AAMC and elsewhere were contacted and some of their recommendations proved helpful in locating additional sources of information.

A compilation of all the references garnered from the above sources is presented in an alphabetical bibliography at the end of this report. Extensive overlaps in the subject matter of the references mitigated against any attempt to arrange them by subject headings. While the diverse nature of the sources made it extremely difficult to use any one standardized bibliographic form, we generally relied upon the

Publication Manual of the American Psychological Association, Second Edition for guidance in presenting the references.

This report was prepared by Janet Melei Cuca, Research Associate; Linda A. Sakakeeny, Research Assistant; and Davis G. Johnson, Ph.D., Director, AAMC Division of Student Studies.

CHAPTER I

HISTORICAL OVERVIEW OF

NATIONAL TRENDS IN MEDICAL SCHOOL ADMISSIONS

The purpose of this chapter is to provide a broad historical perspective against which changes in the admissions process during the past twenty years can be viewed and understood. Particular emphasis is placed on the relationships that were apparent between the medical school admissions process and the meeting of institutional and national objectives. Since several important precursors of these relationships appeared during and immediately after World War II, a brief summary is also provided of that period.

World War II and the Early 1950's

To fulfill military manpower needs during the War, the selection of medical students was made primarily by Army and Navy officials in consultation with medical school admissions officers. Since the premedical program was also largely under the auspices of the military, it was possible to evaluate students within each region and to assign them to a medical school within that region. During the War, 80 percent of the available places were filled by this admissions technique. The remaining 20 percent of the students were selected solely by the medical schools from draft-exempt men and from women (Cooper, 1976b).

Another major change in the admissions process came immediately following the War. Thanks to the G.I. Bill and to the large number of potential medical students who had been in the military service several years, a four to one ratio of applicants to places in medical school occurred in the late 1940's in contrast to the two to one ratio that had existed prior to the War (Johnson and Hutchins, 1966).

Since the federal government financed much of premedical and medical education during and immediately after World War II, the objectives of increased equal educational opportunity were able to be met to a greater degree than before.

Another noteworthy development prior to 1955 was the early effort to interpret the medical school admissions process to applicants and to the public at large. The year 1950 saw publication of the first edition of the AAMC's Medical School Admissions Requirements book (AAMC, 1976c).

A preliminary version, however, entitled Handbook for Advisors to Students Planning to Enter Medicine, was published by the AAMC in 1947.

1955 Through 1959

The second half of the 1950's saw several major efforts to analyze and improve the medical school admissions process. Of particular significance was the Fourth Teaching Institute held by the AAMC in 1956, which was devoted entirely to the topic of medical school admissions (Gee and Cowles, 1957). Participants in the Institute included not only admissions officers and/or other appropriate representatives from each U.S. medical school but also national experts in testing, evaluation and selection. In preparation for the Institute, extensive questionnaires were sent to each medical school relative to their admissions process. Related questionnaires were also completed by almost all medical students admitted to the 1956 entering class in order to obtain their critique of the admissions process (AAMC, 1956).

This Institute not only served to educate admissions officers concerning the state of the art in student selection but it also resulted in a detailed report of the proceedings and reference materials, which served as a guide to newly appointed admissions officers for years to come (Gee and Cowles, 1957).

An important outcome of the Institute was the organization the following year of the AAMC Continuing Group on Student Evaluation (now called the Group on Student Affairs or the GSA). As described by Johnson and Tuttle (1973), this organization brought medical school admissions officers together in annual regional and national meetings and in committees thus allowing them to continue their joint efforts to analyze and improve the admissions process. Their yearly regional and national meetings typically included detailed discussions of both the medical student selection process and of new research on that topic (AAMC, 1958a).

Due to a relative shortage in the number of applicants during the 1950's, a major focus of the 1956 Teaching Institute, of the GSA meetings and of publications such as Medical School Admissions Requirements was on the need to recruit more and better candidates. It was during this period that the admissions officers of some schools with strong state residency requirements literally felt that they were "scraping the bottom of the barrel" to fill the last few places in their entering classes. Indeed, the declining talent pool for medical school admission was generally viewed as a national problem (AAMC, 1962).

Another probable reason for the lack of candidates to U.S. medical schools (above and beyond the shortage of 22 years olds) was the 1957

launching of SPUTNIK by the Russians. The consequent increased popularity of careers in engineering and the physical sciences aggravated the problem of a shortage of qualified medical school applicants. In spite of this shortage, the need for physicians was so great that the late 1950's saw several national reports calling for more medical schools, increased enrollments and more graduates in order to meet projected health manpower needs of the future (AAMC, 1958b; Surgeon General's Consultant Group, 1959).

1960 Through 1964

To help meet institutional, state and national objectives of a larger applicant pool from which to pick higher quality candidates, the early 1960's saw several major efforts to increase the financial incentives for applying, entering and remaining in medical school.

The earlier efforts along these lines came from the private sector. For example, in 1961 the Avalon Foundation of New York City gave grants for student scholarships to each of the 86 U.S. medical schools, totaling approximately $1,100,000. In the words of the Foundation news release, "The grants are designed to attract more students and more competent students to the study of medicine and to help meet the present need for more physicians in the United States." The significance of these grants becomes apparent when one considers that the total scholarship expenditures by all U.S. medical schools in 1959-60 was only $2,252,000.

The first major financial incentive from the federal government to attract and retain medical students came in the form of the Health Professions Educational Assistance Act of 1963, which included a provision for student loans. Also during the 1960's, some of the state governments started supporting private schools in return for the schools giving admissions preference to residents of the state (Cooper, 1976b).

In addition to the shortage of qualified applicants, the growing attrition rate of medical students during the early 1960's stimulated further efforts to analyze and improve the admissions process (Penrod, 1964). A national study of medical student attrition, under the auspices of the AAMC Group on Student Affairs, was begun in 1962 and reported in final form in 1966 (Johnson and Hutchins). Since most of the study activity was carried out prior to 1966, it is discussed here rather than in the next section of this chapter.

The study included site visits to 20 medical schools, analysis of over 4,000 detailed questionnaires and numerous discussions of attrition at regional and national meetings of admissions officers. Perhaps even more than the final report itself, this "process" of studying the attrition problem served to sensitize admissions officers and deans to what

could be done to improve admissions and retention. Pertinent suggestions from that study in the area of admissions are summarized below:

Enlarging the Applicant Pool

1. Encourage the reduction of geographical restrictions on the basis that it is better to graduate nonresidents who may practice in your area than to fail residents who can't practice medicine anywhere.
2. Recruit at both high school and college levels, using such devices as career days, future physician clubs, explorer scouts, and summer research programs. At some schools medical students and even accepted applicants function as recruiters.
3. Increase sources of available financial aid for students. One school recently added 30 admissions scholarships for 1 entering class.

Improving the Selection of Students

1. Appoint qualified, knowledgeable admissions committees which are comprised of senior faculty, psychiatrists, and psychologists. Some schools finance regular luncheon or dinner meetings for these committees.
2. Provide for more intensive screening of applicants who are of questionable maturity, motivation, or stability. Some schools also interview spouses of applicants.
3. Increase efforts to acquaint applicants with the nature and demands of modern medical education. Some schools devote a full day to orienting and interviewing applicants, making extensive use of upper-class medical students in this process.

(Johnson and Hutchins, 1966, p. 1185).

Other efforts to improve the admissions process during the first half of the 1960's included the initiation of The Advisor, a newsletter for premedical advisors, and the production of the first edition of the Medical College Admission Test Handbook for Admissions Committees (AAMC, 1964). The latter publication and its successor (Sedlacek, 1967b), although both are now out of print, are landmark references concerning the reliability, validity, and predictive powers of the MCAT.

The early 1960's also saw the formation of a national MCAT advisory committee. This committee, composed of admissions officers from various regions of the country, served to advise the AAMC on the monitoring and use of this examination. Because of the shortage of applicants and

rising attrition, a major initial focus of the committee was on better use of the MCAT to identify candidates who could successfully obtain the M.D. degree and go out into the practice of medicine.

Finally, this five year period was marked by the publication of a substantial number of articles concerning more efficient and reliable methods of selecting medical students. These articles are discussed in greater detail in later sections of this literature review, particularly in Chapters IV and V.

1965 Through 1969

Compared with the previous ten years, the period from 1965 through 1969 saw a ferment of activity directed at meeting institutional and national objectives. These activities included a number of changes in the admissions process.

It was during this period of time, for example, that a series of Josiah Macy Foundation workshops and meetings helped sensitize medical school administrators and admissions officers to the need for equal opportunity in medicine for women (Lopate, 1968) and for minority group students (Johnson, 1968b). Some of these meetings were co-sponsored by the AAMC and others were under the sole auspices of that association (Johnson, 1969).

This period of the Vietnam War, the assassination of Dr. Martin Luther King, Jr., the Civil Rights movement and the women's movement also culminated in a considerable amount of medical student activism. (Johnson, 1968a). All these factors encouraged admissions officers to add students, women, and members of minority groups to their recruiting and retention efforts (Jarecky, 1969).

Increased financing from the federal government in the form of student scholarships, capitation grants, etc. helped encourage the meeting of these national objectives. (See particularly page 277 of Cooper, 1976b.)

The late 1960's also saw substantial funding from the Office of Economic Opportunity (OEO) via the AAMC which helped finance activities directed at the recruitment, admission and retention of minority group medical students (AAMC, 1971b). Related efforts of the AAMC included a) the establishment in 1969 of a Medical Minority Applicant Registry (Med-MAR) and b) the publication that same year of the first edition of Minority Student Opportunities in U.S. Medical Schools (MOUSEMUS) (AAMC, Div. of Student Programs, 1975).

The Student American Medical Association and the Student Health Organization were increasingly active during the 1960's and helped pressure the medical schools to modify their admission practices (Johnson, 1968a; Graham and Royer, 1973). Likewise, the admissions officers themselves were encouraging change through such forces as the AAMC Group on Student Affairs' Committee on the Medical Education of Minority Group Students, which was established in 1968 (Johnson and Tuttle, 1973).

Another major breakthrough, as far as applicants and their premedical advisors were concerned, was the long-awaited decision to release MCAT scores directly to the students, starting with the May, 1968 test. (AAMC, 1969b, p. 422). In the past, these scores had been treated as confidential in the belief that applicants and their advisors might put undue pressure on the medical schools to admit those students with high test scores but with inadequate personal qualifications. This action resulted in part from encouragement by those preprofessional advisors who started organizing in the late 1960's as regional groups (Grant and Bennett, 1968).

Motivated in part by the ascending curve of applicants per number of available places, the American Medical College Application Service (AMCAS) was developed in the late 1960's and pilot studies were conducted in 1968 and 1969 (AAMC, 1970c). As detailed in Chapter II, AMCAS allows applicants to submit a single application and a single set of transcripts which are processed by the AAMC and forwarded to participating medical schools. It also provides an excellent research base for analysis of trends in student characteristics which can document changes in the admissions process, especially those changes related to meeting institutional and national objectives for diversified physician manpower.

The 1970's

Because the 1970's have seen an even more rapid acceleration in the numbers of applicants than was true in earlier periods, there has been an intensification of the efforts of the late 1960's to analyze and improve the admissions process. Both the intense pressures on admissions committees and a number of suggested solutions to these pressures have been summarized by Green and Johnson (1972).

Strong encouragement to solve basic health manpower problems also came from the federal government during the early 1970's. For example, Elliot Richardson (who was then Secretary of the Department of Health, Education and Welfare) stressed, at the 1971 AAMC Annual Meeting, the urgent need to overcome national problems of geographical and specialty

distribution (Richardson, 1972). Similarly, with the passage of Public Law 92-157, the U.S. Congress encouraged the increased enrollment of individuals most likely to meet such needs (U.S. Congress, 1971).

The 1970's have also been characterized by a growing "institutionalization" of efforts to improve the admissions process. For example, the AAMC Committee on the Expansion of Medical Education, in its September 1970 report, made a number of specific recommendations concerning the supply of qualified applicants and what should be done to find places for them. Objectives of the proposed program included not only increasing the physician-population ratio but also achieving better geographic distribution, less dependence upon foreign medical graduates and a more rational distribution of physicians in the various specialties (AAMC, 1971a).

In April of 1970 the AAMC Task Force to the Inter-Association Committee on Expanding Educational Opportunities in Medicine for Blacks and Other Minority Students submitted a report which included a recommended short-range target of 12 percent minority admissions by 1975-76 (AAMC, 1970a; Nelson, Bird & Rogers, 1970). This report was later endorsed by the AAMC Executive Council as well as by the American Medical Association. The report was reinforced by articles such as that on "Curbing the Black Physician Manpower Shortage" (Thompson, 1974).

Because of the increasingly large numbers of U.S. citizens going abroad for their medical education, the AAMC also initiated in 1970 a Coordinated Transfer Application System (COTRANS) which has assisted a number of those studying abroad to return and to gain advance standing in U.S. medical schools (Dubé, 1975).

Another institutionalized development was the formation in 1971 of the AAMC Organization of Student Representatives (AAMC, 1972a). OSR has provided medical students direct input to the AAMC rather than having to "grab the microphones" as they did during the student activist days of the 1960's (Johnson, 1968a). Among the significant contributions of OSR to the admissions process have been several formal resolutions calling for the AAMC to gather and disseminate to prospective applicants and to premedical advisors more data on medical school admissions. OSR-sponsored resolutions approved by the AAMC assembly in 1973 called on the AAMC for: a) the inclusion of more extensive information in Medical School Admission Requirements about student characteristics (including sex and minority group composition) at each school and b) assistance to undergraduate colleges in providing information to their premedical students regarding the results of applications to medical schools from their preceding classes of premedical students (AAMC, 1974b). Both of these resolutions have been carried out by AAMC staff.

Another significant effort to improve the admissions process during this decade was a $10,000,000 grant in 1972 from the Robert Wood Johnson Foundation for use by medical schools from 1972 to 1976 in recruiting and

retaining students who are female, from underrepresented minority groups, and/or from rural areas. It was assumed that these individuals would be more apt to meet the geographical and specialty manpower needs of the nation. This grant was administered by the AAMC (AAMC, 1973c).

Several projects were also carried out in the early 1970's that related to the makeup and functioning of medical school admission committees. (Oetgen and Pepper, 1972; Graham and Royer, 1973). A major thrust of these projects was to encourage greater representation on admission committees of students, minority group members and community representatives. Although not completely documented, it is probably true that in the 1950's and early 1960's, most medical school admission committee members were full-time faculty who placed a significant emphasis on research (Gee and Cowles, 1957). Accordingly, they may have been more inclined to pick students with similar leanings. Admissions committees of the 1970's include more students and minority group members (Oetgen and Pepper, 1972; Lambson, 1975b).

Due in part to the increasing numbers of applicants, a medical school admissions matching plan was finally given a trial in 1973 after many years of discussion (Cooper and Davenport, 1953). Although a matching plan was proven to be technically feasible, it was decided that its disadvantages outweighed its advantages. Consequently, it was not implemented on a national level (Report of the AAMC ..., 1975, p. 7).

Also due in part to the improved qualifications of applicants, the Medical College Admission Test became somewhat less predictive of success in medical school during the 1970's. For this and other reasons, a major effort has been undertaken to revise the MCAT and to develop a new Medical College Admissions Assessment Program (MCAAP). Although early emphasis will be on measures of cognitive skills (including problem solving), it is intended eventually to develop measures of non-cognitive qualities (AAMC, 1973b). This program is discussed more fully in Chapter IV.

Special efforts are also being made to devise admissions techniques that will help detect qualified students from disadvantaged backgrounds whose credentials may not conform to traditional standards of evaluation. A major endeavor along these lines has been the AAMC development of the Simulated Minority Admissions Exercise (D'Costa et al., 1974) which has now been carried out at a significant number of medical schools and at regional meetings of minority affairs officers, admissions officers and medical school deans. These workshops help to sensitize those involved in the admissions process to the complex issues involved in selecting "nontraditional" applicants. This program also, is more fully discussed in Chapter IV.

In connection with minority admissions, the 1970's have also seen a significant number of actual or threatened lawsuits against medical schools and their admissions committees. These suits have usually

claimed that the applicant in question had been rejected while ostensibly less well qualified candidates were accepted. The AAMC has conducted several surveys related to admissions lawsuits (AAMC, 1972b and 1975d), and filed Amicus Curiae Briefs in relation to both the DeFunis case (AAMC, 1974a) and the Bakke-Davis case (AAMC, 1976a). It has also recently established a Task Force on Minority Opportunities in Medicine to help determine why there has been a dropoff in minority applicants (AAMC, 1976d). Hopefully, the findings of this Task Force may help meet institutional and national objectives to increase the representation of qualified minority group members in the study and practice of medicine.

Because of concern that rising tuitions and decreasing financial aid may result in future medical school applicants coming mainly from upper income backgrounds, the AAMC has also recently established a Task Force on Student Financing. Both of these Task Forces, appointed in early 1976, are to present final reports to the AAMC Executive Council by the Spring of 1978 and interim reports along the way (AAMC, 1976d).

Finally, a growing awareness on the part of medical school officials of the need for selecting students who are most likely to enter primary care specialties and to serve geographical areas of national need (AAMC, 1975b) illustrates the increased emphasis on helping meet societal needs through the admissions process (Colwill, 1973, 1976). Thus, whereas 20 years ago most admissions officers were primarily concerned with choosing the academically best qualified applicants, today's admissions officers are trying to recruit and select students who will also meet the objectives of their institutions and of society.

The remaining five chapters of this special report present a review and synthesis of the literature concerning the medical school admissions process (and related issues) that has been produced over the past twenty years.

CHAPTER II

LOGISTICS OF THE APPLICATION PROCESS

As reported in the previous chapter (Historical Overview), the past two decades have seen considerable change and evolution in the admission process to medical school. Particularly since the mid-sixties, the logistics of the application process has become vastly more complex due to the increase in volume of applications (see Table 2.1). The increased complexity necessitated a refinement and sophistication of the entire procedure.

The major technical aspects of the application process have been examined in this literature review; and it was found that many changes have occured in a) the computerization of the application process; b) paperwork processing; c) timing of the application process; d) processing costs and information dissemination to prospective applicants; and e) recruitment programs. The latter two types of changes, in particular, were found to have facilitated the increased application of students from groups previously underrepresented in medicine.

Computerization of Application Process

One of the most significant changes which has affected all of these elements was the development of the American Medical College Application Service (AMCAS) in the late 1960's by the AAMC. By using this service, "applicants to AMCAS-participating schools initially submit only one set of application materials and official transcripts, regardless of the number of schools to which they are applying. While AMCAS does not render any admissions decisions and does not advise applicants where to submit applications... (it) benefits both the participating medical school and the applicant by collecting, processing, and coordinating data, effectively reducing the time and, in many cases, the expense of the application procedure" (AAMC, 1976c, p. 22).

Students applying to schools that do not participate in AMCAS pay an average of $20 per application. Some AMCAS-participating schools, however, do charge an additional fee of their own. AMCAS provides a service fee waiver program for applicants from families whose inability to pay the AMCAS service fee would prevent them from applying to medical school. Many individual schools also make such allowances in reference to their own application fees.

TABLE 2.1

Application Trends for Classes Entering U.S. Medical Schools in 1955, 1965 and 1975

	1955	1965	1975
Number of Applicants	14,937	18,703	42,303
Number of Applications	54,161	87,111	366,040
Applications per Individual	3.6	4.7	8.7

* * * * * * * *

	Percent Increase	
	1955-1965	1965-1975
Number of Applicants	25.2	126.2
Number of Applications	60.8	320.2
Applications per Individual	30.6	85.1

Sources: AAMC, Applicant Studies and Applicant Datagrams

Along with the development of AMCAS, computerized application systems were being used by at least one state school system (Rankin, 1972) and "many individual schools were using computerized methods for information retrieval and/or data analysis in their admission process" (Rosenholtz and Andreatta, 1974 p. 1059).

Through a survey conducted in 1965, the AAMC found that about a dozen schools employed a computer in the admissions process (Thompson, 1968). Thirty-seven percent of all medical schools anticipated using computers for these purposes in the future. Rosenholtz and Andreatta described ways in which medical schools could integrate their computer systems with AMCAS thereby providing themselves with a highly sophisticated data base. Thus, "the Admission Committee chairman, for example, (would be able) to provide information quickly to any or all of the following:

1. Individual committee members concerning the specific candidates they interviewed.

2. The entire committee, noting its recent actions and overall actions to date, the work yet to be done, or the records of selected candidates to be discussed at an upcoming meeting.

3. Office staff about the applicant pool, listing systematically in alphabetical or numerical order key sub-categories of the processed or to-be-processed pools." (Rosenholtz and Andreatta, 1974, p. 1060)

Much earlier than this, some medical schools were already reporting success in the use of computer systems for processing applications. In 1963, the Admissions Committee of the Downstate Medical Center College of Medicine began experimenting with the use of a computer system to compile application information (Hill and Siegel, 1966). The school found the system extremely useful in several areas: a) grouping applicants according to their objective records (GPA's and MCAT scores), b) helping to manage the selection procedure, c) rapidly assessing the state of the applicant pool, d) providing data for admissions research, and e) keeping the applicant informed of his or her status.

Rimm, Pazdral, and Sine (1968) described a computerized system used at Marquette Medical School. This system was utilized to "queue" applicants for interviews by weighting various factors such as MCAT scores, GPA, and undergraduate college selectivity.

In 1973, Ambrosino and Brading reported on "an experimental, analytic computer-based methodology for determining the interview status of medical school applicants" (p. 332) at the Albany Medical College. The College had "experienced over a 65 percent increase in applications since the 1969-70 application season" and therefore was in need of some form of computer assistance in handling the massive volume of applications.

Stepwise multiple regression procedures were used on quantitative variables taken from each student's application to predict the academic quality of a student's preclinical years. On the basis of this predictio it was then decided whether to interview the applicant as soon as possibl (if his or her academic credentials were clearly acceptable), to reject the applicant immediately, or to examine the applicants' credentials more carefully before making a decision. In the experiment, the results (i.e. the admissions decisions) predicted by the computer-based procedure were compared with the results of the admissions committee, and it was decided that with further refinement of the computer system its accuracy would make it well worth utilizing.

In an editorial dealing with the above study, Peterson (1973) points out some of the controversial aspects in this type of screening method. The argument he puts forth is based on the fact that admissions committees really do not know what constitutes a "good doctor" and there is little concrete evidence that grades in medical school correlate with physician performance (Wingard and Williamson, 1973). Therefore, to base the initial screening on quantitative predictors of preclinical grades could be interpreted as a poor method of evaluation. Goldhaber (1972) also critized the trend toward automated initial screening of applicants because of its reliance on MCAT scores and GPA's. The problem, however, is a complex one with practical, logistical considerations playing an important role in the equation. A review of the literature involving the range of criteria, predictability of criteria, and weighting systems used is provided in subsequent chapters.

Paperwork Processing

When the number of applicants first began to escalate dramatically, Johnson (1965) recommended the use of preliminary application forms and wider use of the Early Decision Plan. Green (1966) reported that nineteen medical schools were using a preliminary application form in order to cut down on the paperwork, time, and costs involved in processing applications. Appearing on these forms is only that information which is used by the admissions committee for preliminary screening, usually GPA of premed science courses, MCAT scores and state of residence. If an applicant passes this phase of the screening process, he or she is then asked to submit a full application which includes complete transcripts, letters of recommendation, a personal statement, etc. As noted earlier, this two-phase type of system has its critics (Goldhaber, 1972; Peterson 1973) since the initial screening is based mainly on quantitative criteria. However, most schools which utilize a preliminary application form are willing to reconsider applicants who feel that their rejection in this initial screening phase was unfair and that a full application would better explain their background.

Teitelbaum, Elstein, Rex et al. (1973) report on related efforts by the College of Human Medicine at Michigan State University to streamline their admissions process. The admissions committee stipulated the variables to be used in the decision-making process and the weight to be given to each. An Application Rating Form was then devised which incorporated these variables. These rating forms were completed for each applicant by two administrative staff members, rather than by members of the admissions committee. Those applicants who received scores of 36 points or higher were sent secondary applications to complete and were asked to submit letters of recommendation. These materials were then scored and, on the basis of their combined scores, applicants were either asked for an interview or put into a hold category. The interviews were all conducted by members of the admissions committee who were responsible for evaluating the interview on an Interviewing Rating Form. The interview score was then added to the overall score, and the top ninety applicants were approved for admission. According to the authors of this study, this procedure reduced the cost of processing their applications from approximately $3000 per applicant to approximately $800 per applicant.

Several studies such as those by Motto and Werner (1965b), Jackson and Kellow (1958), and Litton-Hawes, MacLean and Hines (1976) have dealt with the improvement of the admissions interview. These will be discussed in Chapter IV. Those studies concerning the use of weighting systems will be discussed in Chapter V.

In spite of the continuing sophistication and streamlining of the admissions process, some have expressed the need for further changes. Cooper (1953) and Marcus and Riggs (1974), among others, have suggested the development of an admissions matching plan similar to the computerized National Internship and Residency Matching Program (NIRMP). However, as Ceithaml (1974) and Green and Johnson (1972) have pointed out, in the case of the NIRMP there have traditionally been more internship and residency places than there have been students to fill them, whereas in the medical school admissions process there are far more applicants than places. Accordingly, a matching program might enlarge the number of applications and therefore increase the workload of admissions committees.

In 1972, the AAMC Council of Deans recommended that "the Association President and appropriate staff explore ... the feasibility of a medical school admissions matching program." A pilot program was subsequently conducted and a summary of the results and recommendations were as follows:

Advantages

- For medical schools, the only discernible benefit of matching might be the reduction of paper work associated with sending letters of acceptance and keeping records of responses.

• For applicants, matching might--if appropriately timed and used by a sufficient number of medical schools--reduce current levels of anxiety.

Disadvantages

• Matching alone would not decrease the total volume of applications, which is the crux of what has been called the "admissions crisis."

• Matching would require strict adherence to rigid deadlines for submission of rank order lists by both applicants and participating schools. School rank order lists would probably have to be submitted to the central processing office not later than April 1. It would therefore be necessary for all participating schools to have completed all application processing and interviews and to have ranked an appropriate number of applicants by that date. This might be a serious problem, particularly for schools which normally offer many more acceptances than there are places available in order to fill a class.

• One aspect of the matching process which has assumed increasing importance during the course of the pilot program is that of "balanced classes." It is technically possible for the matching algorithm to take into consideration such applicant characteristics as sex, minority group, and state of residence. In order to achieve a desired mix of students according to these characteristics through matching, however, it would be necessary for medical schools to divide subsets, in effect establishing quotas for each group. It is probable that this would be inconsistent with current legal trends.

• It is estimated that the costs related to development, school and student education, programming and processing of an admissions matching system would total $500,000 at a minimum.

In summary, it was concluded that matching would seem to offer more disadvantages than advantages to medical school admissions processing. In addition, the introduction of admissions matching at this time would likely impose new stresses on a system which has begun to accomodate to the "crisis" conditions observed three years ago. ("Report of the AAMC...", 1975, p. 7)

It was therefore decided to abandon the admissions matching proposal at the national level and to continue to monitor and refine the admissions process in other respects.

While the AAMC pilot program proved that an admissions matching plan was technically feasible but impractical on a national scale, the University of Texas System found, through their own pilot admission matching program, that "admission matching can and does work efficiently for schools which share to a great extent a common willingness to work together" (Padgett, Rankin, and Knisely, 1976, p. 486). Because of the success of their pilot study, the Texas University System decided to implement such a matching program. Figure 1 illustrates the Admission Matching System flowchart for the University of Texas medical schools which is included in each application packet.

Timing of Application Process

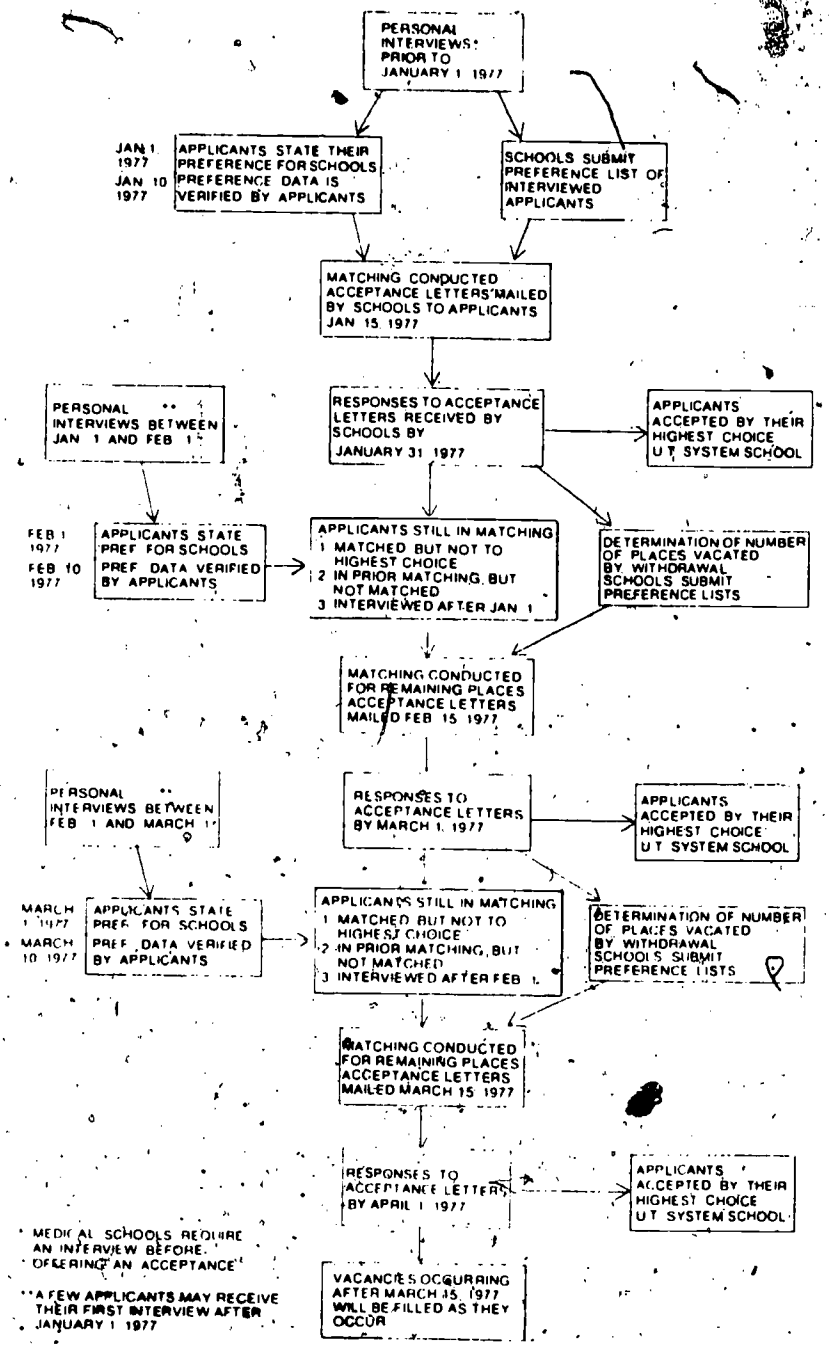
In spite of the controversial issues they may raise, the widespread use of data processing and preliminary application forms in the application process have helped alleviate many problems, not the least of which is timing. Schedules and deadlines are more easily met by both the applicant (with the use of AMCAS) and the medical school (using AMCAS and individualized systems). However, the actual timing of the application process was a problematic issue long before the escalation of applications in the 1960's. At one time, it was not uncommon for some medical colleges to accept students and require sizeable nonrefundable deposit fees more than a year before matriculation.

The AAMC helped to solve most of these problems by issuing recommendations at several points in time which would standardize the so-called "traffic rules." Johnson, Levitt, Little, and Morris (1963) reported that as early as 1949, the Executive Council of the AAMC agreed that medical colleges should not accept applicants more than one year before their matriculation as medical students. In 1952, the Council added its disapproval of the practice of requiring deposit fees prior to the January 1 of the same year as entrance to medical school. In 1953, the AAMC institutional membership approved the Council's recommendations and in 1954 the "traffic rules" were adopted almost unanimously by this group.

As shown in Table 2.2, the 1954 "traffic rules" set the deposit fee deadline date at January 15, and the maximum deposit at $100. By 1960, the "traffic rules" were modified to meet the needs of medical schools with experimental programs and were retitled the "Recommended Acceptance Procedures of the AAMC." These procedures have since been revised periodically and are published each year in Medical School Admissions Requirements (MSAR) (see Tables 2.2 and 2.3 for the 1954 and 1976 recommended acceptance procedures).

FIGURE 2.1

The University of Texas Admission Matching System Flowchart Diagram that is Placed in Application Packets



Source: Padgett, Rankin, and Knisely, 1976, p. 180.

TABLE 2.2

ACCEPTANCE PROCEDURES—TRAFFIC RULES* (approved in 1954)

1. No place in the freshman class shall be offered to an applicant more than one year before the actual start of instruction for that class.

2. Following the receipt of an offer of a place in the freshman class, a student shall be allowed at least two weeks in which to make a written reply to the medical school.

3. Prior to January 15, this written reply may be either a declaration of intent or a formal acceptance of the place offered. When the applicant has declared his continued interest within the two-week period, the medical school agrees to hold a place for him until January 15, unless he indicates that he has been accepted elsewhere and withdraws his application. He may, of course, and often will, enter into formal arrangements with the one medical school of his choice before January 15. Because of the wide variation in the acceptance dates of different medical schools, some students will wish to change their minds after filing a declaration of intent and it is understood that nothing unethical is implied when a student does so change his mind. In such an event, the student is obligated to send prompt written notification to every school holding a place for him.

4. The payment of a nonrefundable deposit shall not be required of any applicant prior to January 15.

5. When a student files a declaration of intent, a refundable deposit—not to exceed $100—may be required at the discretion of the school granting the acceptance. Such deposits will be refunded without question upon request made prior to January 15.

6. The deposit, when required to hold a place in the freshman class after January 15, shall not exceed $100.

7. By January 15 each applicant for whom a place in the entering class is being held must either accept the offer formally and pay any required nonrefundable deposit or withdraw his application.

8. Following January 15, an applicant offered a place in a freshman class must either formally accept or refuse the place, but he shall have at least two weeks in which to decide. Deposits made after January 15 shall be nonrefundable.

9. To assist the medical schools, the AAMC office will compile a list of the students who have formally accepted a place in the freshman class. This list will be distributed about February 1 and will be kept current by frequent revisions.

*These are the recommended procedures of the Executive Council of the Association of American Medical Colleges and have been approved by the membership of the Association. These so-called traffic rules are now observed by most medical schools.

Source: Gee and Cowles, 1957, p. 199.

TABLE 2.3

Recommendations of the AAMC Concerning Medical School Acceptance Procedures (Revised September 1975)

For the information of prospective medical students and their advisers, the recommended procedures for offering acceptance to medical school and for student responses to those offers are printed below:

1. Each medical school should prepare and distribute to applicants and college advisers a detailed schedule of its application and acceptance procedures and should adhere to this schedule unless it is publicly amended.
2. Each medical school should agree not to notify its applicants (except for those applying via EDP) of acceptance prior to November 15 of each admission cycle.
*3. An applicant should be given at least two weeks to reply to an offer of admission. After that time, an applicant may be required to file a statement of intent, or a deposit, or both. The statement of intent should provide freedom to withdraw if the applicant is later accepted by a school which he or she prefers, the deposit, which should not exceed $100, should be refundable without question. The refundable deposit may be credited against tuition charges if the applicant matriculates at the school.
*4. No medical school should use any device which implies that acceptance of its offer creates a moral obligation to matriculate at that school. Every accepted applicant should be free to deal with all schools and to accept an offer from one of them even though a deposit has been paid to another school. Every accepted applicant does retain under all circumstances an obligation to notify a school promptly of a decision not to accept its offer and to withdraw at once if, after accepting an offer from one school, the applicant receives and accepts an offer from another school.
5. By April 1, an applicant who has received offers of admission from more than one school and has received all financial aid information from the schools necessary to make a decision and has had at least two weeks to consider each offer should choose the one school which he or she prefers and withdraw from all other schools at which he or she has been accepted.
6. Each school is free to make appropriate rules for dealing with accepted applicants who, without adequate explanation, hold one or more places in other schools. These rules should recognize the problems of the student who has multiple offers and also of those applicants who have not yet been accepted.
7. Subsequent to June 1, a medical school seeking to admit an applicant already known to be accepted by another school for that entering class should advise that school of its intent. Because of the administrative problems involved in filling a place vacated just prior to the commencement of the academic year, schools should communicate fully with each other with respect to anticipated late roster changes in order to keep misunderstandings at a minimum.
8. After an applicant has actually enrolled in a U.S. medical school, no further acceptances should be offered to that individual. Once enrolled in a school, students have an obligation to withdraw their applications promptly from all other schools. Enrollment is defined as being officially registered at a school on or subsequent to the formally publicized starting date for the first-year class of that school.

*Most of these two procedures do not pertain to students accepted under the Early Decision Plan (EDP) because such students agree in advance to attend a given medical school if offered a place during the "early decision" segment of the application year.

Source: AAMC, 1976c, p. 31.

In 1973, a four-stage plan was developed by the AAMC to help alleviate the problems caused by an over-abundance of applicants and applications. The four aspects of this plan included: a) better information dissemination to applicants and preprofessional advisors which would help to cut down on the number of applications filed per applicant; b) development of an Early Decision Plan; c) uniform acceptance dates; and d) rolling admissions (Johnson, 1973).

Following the above recommendations, many schools now use some or all of the AAMC-suggested Uniform Acceptance Dates for notifying applicants of their admission to medical school. These dates are currently December 15, January 15, February 15, and March 15. The majority of schools also have agreed not to notify applicants (except those applying through the Early Decision Plan) of acceptance prior to November 15 of each admission cycle (AAMC, 1976c).

The Early Decision Plan (EDP), which began nationally in 1973, permits an applicant to file a single application (usually prior to August 15) and guarantees that the applicant will receive a prompt decision by that school (usually on or prior to October 1). Should applicants not be admitted as an early decision candidate, they may be reconsidered by that school as a regular candidate and, of course, may then apply to other schools. Applicants who opt for early decision may not apply to any other U.S. medical school during the time their credentials are being considered for early decision, and if admitted to an early decision school, the applicant must then attend that school. If not admitted, the applicant may then apply to other schools.

For the 1976-77 entering class, 58 schools accepted 884 students under EDP from a total of 2,141 applicants. Since the average applicant currently files 8 or 9 applications, however, this represents a saving of over 7,000 applications which would otherwise have had to be processed by the medical schools.

According to Medical School Admission Requirements (AAMC, 1976c, p. 30), "As EDP becomes even more widely understood by applicants and their advisers, it is anticipated that the number of EDP applicants and acceptees will increase. The newly-established November 15 first acceptance date for regular candidates should also encourage more widespread use of EDP. It should be emphasized, however, that only applicants with a clearly excellent chance of admission at a particular school are advised to apply under EDP because most participating schools admit only a small portion of their class (10 to 25 percent) through EDP. For such strong candidates, however, admission under EDP can greatly reduce the financial and psychological costs of applying to multiple medical schools."

Consideration has also been given to multiple entry points (e.g., advanced placement through qualifying exams) (Magraw, 1969, Mahoney and

and Engelhardt, 1973) and to semiannual admissions (Rittenhouse and Weiner, 1971). The literature on this subject, however, pertains mainly to its effect within the medical school (e.g. on faculty, expenditures, etc.) rather than to the application process.

Processing Costs and Information Dissemination

A related problem has been the high cost of processing the rapidly rising number of applications. In Rosenberg's (1973) study of four medical schools, the costs of the admissions process ranged from $49,000 (to admit a class of 93 students) to over $200,000 (for 140 students). "These costs include budgeted expenses such as salaries for professional and nonprofessional personnel, printing, mailing, and travel and resource expenditures for such matters as faculty time at admissions committee meetings and interviews" (p. 707).

In order to reduce these costs while maintaining the school's admissions objectives, Rosenberg suggests: a) publicizing general criteria by which applicants are selected; b) using a one-page summary sheet as a preliminary screening process for each applicant; c) utilizing the interview in a more efficient manner by interviewing only those for whom additional information is needed (thus precluding those who would either definitely be accepted or rejected regardless of the interview), and by being as specific and objective as possible in evaluating the interview; d) ranking each applicant who passes the preliminary screening along a continuum, assigning each a specific number of points; e) including the summary sheet in the file of those accepted and later adding measures of the student's performance in medical school. These summary sheets could then be used as feedback to the committee on the validity of their decisions.

All of the above suggestions concern procedures which are already in use in some form. The AAMC, for example, disseminates information to applicants through several sources. Particularly since the proposal of the "four stage plan" (Johnson, 1973) mentioned earlier, the Medical School Admissions Requirements (MSAR) handbook published by the AAMC has contained an increased amount of both national and individual school information on the characteristics of the most recent entering class. These characteristics have included GPA's and MCAT scores, undergraduate major, age, sex, residency, and minority group composition, as well as a wealth of other information valuable to applicants. Such information permits the potential applicant to compare his own credentials with those of the most recently accepted class and to estimate his own chances of being accepted. The assumption is that obviously unqualified applicants will, thus, be discouraged from applying to those schools where the likelihood of their being accepted is low. For several years the AMCAS

Information Booklet also contained similar data for participating schools but this is now reported in MSAR in order to avoid duplication.

In addition, the Office of Minority Affairs of the AAMC periodically publishes Minority Student Opportunities in United States Medical Schools (MSOUSMS) (1969, 1970, 1971, 1975). This handbook includes information on minority group recruitment, admissions, academic aid, and related details concerning each medical college.

The Medical Minority Applicant Registry (Med-MAR) is another AAMC-initiated service, which began in 1969 (AAMC, 1970c). This program provides the opportunity for any medical school applicant who wishes to be considered as a minority applicant to have his basic biographical information circulated automatically (at no additional cost to the applicant) to the admissions offices of all U.S. medical schools, as well as to other health services organizations and institutions that request the Med-MAR lists.

Students are invited to participate in Med-MAR by identifying themselves as belonging to a minority group either on a questionnaire completed at the time they take the Medical College Admission Test (MCAT) or by contacting the AAMC directly. Two Med-MAR lists are published annually (usually in July and November) and are circulated to all U.S. medical schools. Upon receipt of Med-MAR lists, medical schools interested in further contact with given students correspond with them directly and request that they file more detailed application materials (AAMC, 1976c).

In addition to the above sources of information, each medical college publishes its own catalogue which serves as another detailed resource for the prospective applicant. Thus, by making it as easy as possible for prospective applicants to obtain accurate information on admission requirements, the AAMC and the individual medical schools are assisting both the student and the schools. The students should be better prepared to decide realistically whether to apply and where to apply, while the schools should be able to reduce the volume of inappropriate applications.

Recruitment Programs

Recruitment programs also play a part in publicizing the general criteria by which applicants are selected and in dispelling misconceptions. During the past decade, schools have had far more qualified applicants than could be admitted, but previously most schools actively recruited students. From the mid-fifties to the early sixties, medical schools were losing applicants to other science professions, especially with the burgeoning popularity of the space program.

This problem was articulated by various participants in AAMC's Fourth Annual Teaching Institute (Gee and Cowles, 1957), at which much of the focus was on the dearth of qualified applicants to medical schools. Some state-supported medical schools, with residency restrictions among their admissions criteria, were especially hard-pressed to find enough qualified applicants to fill their entering classes. Fifteen percent of the participants (who had all filled out a lengthy questionnaire just prior to the meeting) considered recruitment of potential candidates a serious problem, while 43% considered it a moderate problem and 41% felt it to be little or no problem (AAMC, 1956).

In 1965, the applicant pool had increased somewhat, but many medical schools were still seeking out applicants. Three senior medical students at Western Reserve University School of Medicine (Aronson, Baumann and Aronson, 1965) described the manner in which medical school applicants went about choosing a medical school and suggested that medical schools utilize this information in recruiting students.

After tabulating the results of a questionnaire sent to all four classes at Western Reserve, Aronson et al. found that the three sources of information which students considered most valuable in their deciding to attend Western Reserve were the school catalogue, the admissions committee interview, and other medical students. The four most important types of information influencing an applicant's decision were: the school's general reputation, the teaching program, the school's geographic location, and advice from primary sources of information (e.g., interviewer for the admissions committee and WRU medical students). Secondary sources of information (including premedical advisors, parents, friends, relatives, home town physicians, and WRU alumni) were not considered of much importance by the majority of students in deciding to attend WRU.

The authors concluded that admissions committees should make maximum use of the interview in acquainting promising applicants with the college, its programs, teaching methods, type of student body, etc. and in encouraging applicants to interact with medical students while visiting the campus. This, in conjunction with improving the college's catelogue, would help to entice more good applicants into enrolling in their medical school.

In recent years, much less general recruiting of qualified applicants has been needed at most schools. Instead, the recruiting which has been done has focused on students from those populations previously under-represented in the medical profession, particularly minority students and applicants from rural backgrounds.

The results of a questionnaire distributed by the AAMC in July, 1968 showed that most medical schools were then primarily concerned with recruiting Afro-Americans, and two-thirds of the schools indicated that they had developed special recruiting activities for racial minority group members (Jarecky, 1969). While most of the literature on this subject calls for medical schools to develop better recruitment programs for minorities (Hart, 1974; Henry and Sinkford, 1972; Kaplan, 1970; Josiah Macy, Jr. Foundation, 1971; Blue Spruce, 1972, Buxbaum, 1972; AAMC, 1970a; Sayles, 1975), some of the literature describes existing minority recruitment programs (Curtis, 1971; Ramsay, 1973; Diekema, 1974; Smith, 1974; Gaines, 1975). In addition, various reports examine summer programs which stress academic, study skill, and career guidance for educationally and economically disadvantaged students (Jackson, 1972; Ramsay, 1973; Ortiz and Kender, 1974).

Some schools are also in the process of developing programs specifically aimed at the recruiting of rural applicants in an effort to increase the number of their graduates who will eventually go back to rural areas to practice. Aaron (1976a) reports on a program in Illinois to recruit students from rural backgrounds (see Chapter VI). Research conducted by O'Brien and Bagby (1976) indicates that recruitment of rural applicants needs to start as far back as high school, if these efforts are to be successful.

It should be noted that while the need to recruit qualified non-minority urban applicants is no longer a major problem, there is still a need for medical schools to more fully inform prospective applicants and enrollees about their particular institution and the type of students they seek. A study by Gottheil, et al. (1969) analyzed the effect of "lack of fit" between the student and the medical school on the amount of stress experienced by the student in his/her first year of medical school. They found that the accuracy of a student's preconceptions of the medical school influenced the amount of stress and dissatisfaction experienced in the first year. Those students whose expectations had been realistic fared better, academically and non-academically, than did those with inaccurate preconceptions. The authors stress the importance of matching students to the type of medical school environment in which they would feel most comfortable. This, the authors feel, can best be done by improvements in recruitment programs and information dissemination.

In a survey conducted for the AAMC's Group on Student Affairs by Roger Lambson (1975b), 52% of the student affairs personnel at U.S. medical schools reported being involved in recruitment of students, and 41% ranked recruiting as one of their top three responsibilities. This suggests that, even with a surplus of qualified candidates, medical schools still try to recruit "the best" for their institutions.

In summary, the last two decades have seen many changes in the logistics of the admissions process due to a vast increase in both the number of applicants and the number of their applications. Individual schools have refined and streamlined their methods of processing applications and continue to do so. The development of AMCAS and the use of computers by individual schools has greatly helped in paperwork processing as well as in other aspects of the application process.

The AAMC "traffic rules" have reduced the problems related to timing and to deposit fees and have made the application process more uniform. Preliminary application forms have helped reduce paperwork and costs, and the Early Decision Plan has made life simpler for some applicants and admissions committees. In addition, individual schools, as well as the AAMC, have expanded their efforts to collect, analyze and disseminate data which will be of help to both applicants and admissions committees. Since the late 1960's a special effort has been made to inform minority groups of the opportunities in medicine and to demythicize the admissions process for those population groups who are underrepresented in medical schools.

Several other solutions to the admissions process have been proposed over the years, the more radical of them being (1) a lottery system, (2) open admissions, and (3) quota systems (Green and Johnson, 1972). It seems more likely, however, that the medical schools will continue to change and adapt their admissions logistics along the lines summarized in the previous paragraphs.

CHAPTER III

COMPOSITION AND FUNCTION OF ADMISSIONS COMMITTEES

The admissions committees of medical schools carry an aura of awesome power in the perception of each medical school applicant. Those outside of the actual admissions process generally have a preconceived notion of what constitutes the "average" admissions committee, and how it operates. In order to fully understand the form and function of these committees, one must discard the myths surrounding them and examine the reality.

Unfortunately, this reality is somewhat elusive since the literature on this subject is rather meager. Few schools have published reports describing the composition of their admissions committee, how the committee operates, and how it is structured. Those reports which have been published in various state journals (Henn and Carver, 1971; Hermann and Creek, 1971; DuVal, 1970; Schwarz, 1972; "Managing the University," 1973), tend to be "one shot deals" in that they are not complemented with reports in other years for comparison value.

Funkenstein (1970) felt that "the admissions policies and procedures of medical schools have not changed as rapidly as have medical schools themselves, their students, or the demands of society" (p. 497). He chastised admissions committees for not dealing effectively with the needs of a changing society, and urged its members to analyze their role more closely, thus avoiding impending confrontation with dissatisfied groups both in and outside of the medical school.

It is difficult to assess the amount of change that has gone on in admissions committees since the social ferment of the late sixties. The lack of published material may indicate that the focus of concern is on other aspects of the admissions process, such as the range of criteria used, and special weighting systems for minority applicants (Chapters IV and V).

Nevertheless, one cannot ignore the vital role the admissions committee plays in selecting our future doctors. Therefore, it is worth examining what information can be garnered from the literature of these past twenty years.

The Late 1950's

The most comprehensive single source of information on medical school admissions committees is the Report of the Fourth Annual Teaching

Institute (Gee and Cowles, 1957), which includes data collected from a questionnaire sent to all U.S. medical schools admissions committees and to several non-U.S. schools, as well as to the conference participants (most of whom were also admissions committee members).

The data collected for the Institute covers a wide range of information on the admissions committees, from size and composition to manner of operation. Because this data stands as a landmark in the analysis of the admissions process, it is worth reproducing here that which is pertinent to this chapter, especially since the Report is no longer in print or otherwise easily obtainable.

The manner of appointment to the admissions committee was most often (66 percent of the time) by the Dean of the medical college, with 52 percent of the members being selected from the clinical departments and 41 percent from basic science (Table 3.1). Moreover, they typically included administrative officers, and, not infrequently, a psychiatrist (Table 3.2). The size of the committees ranged from 2 to 12 or more, with most falling between 4-7 (Table 3.3).

While no data was collected on the average length of appointment, one can obtain at least a general idea of the typical turnover rate by examining Table 3.4. However, it should be kept in mind that the data in Table 3.4 deals only with the 40 percent of schools who utilized a rotation plan and no data is available on how the other 60 percent went about changing their membership.

It would be especially interesting to know the manner in which admissions committee members devoted their time outside of committee work in the 1950's. Participants at the Institute were polled and their responses were broken down into teaching, administration (including admissions), research, patient care, and "other activities" (Table 3.5). Unfortunately, not all participants were admissions committee members, so the results in this table are somewhat clouded. Still, from the category "work devoted to administration" and the fact that the Institute was on admissions, one can safely assume that most Institute participants were admissions committee members*. It is therefore interesting to note the small percentage of those participants who were engaged in research and patient care as opposed to the significant number in teaching and administration.

The two major aspects of an admissions committee's work consists of (a) reviewing applications, and (b) developing policies concerning admissions requirements and procedures. In recent years, emphasis has been placed on shortening the amount of time the committee needs to spend on the former, in order to free more time for the latter (Rosenberg,

*This assumption is also confirmed by the third author of this report who participated in the Institute.

TABLE 3.1

TEACHING RANK AND DEPARTMENT OF ADMISSION COMMITTEE MEMBERS

(Committee members group)

Teaching department	% of 534 committee members in each dept. according to teaching rank							Total % in each teaching dept.
	Chairman	Professor	Associate professor	Assistant professor	Other	None	No response	
Clinical:								
Medicine	1	4	5	6	3	0	0	19
Obstetrics-Gynecology	1	1	1	*	0	0	0	3
Pediatrics	1	1	1	1	*	0	0	4
Psychiatry	1	1	2	2	1	0	0	7
Preventive Medicine	1	2	1	*	0	0	0	4
Surgery	*	1	2	2	*	0	0	7
Radiology-Radiobiology	*	*	*	*	0	0	0	1
Clinical joint appointment	0	1	*	*	0	0	0	1
Other Clinical	2	1	1	*	1	0	0	5
Total Clinical	8	12	13	13	6	0	0	52
Basic Science:								
Anatomy	3	4	2	2	*	0	0	11
Microbiology	1	1	1	1	*	0	0	4
Biochemistry	3	2	2	1	0	0	0	8
Pathology	1	2	1	1	*	0	0	6
Pharmacology	1	1	2	*	0	0	0	4
Physiology	3	1	1	*	0	0	0	5
Basic science joint appointment	*	1	*	*	0	0	0	2
Other basic science	0	*	*	*	*	0	0	1
Total Basic Science	13	13	9	5	1	0	0	41
Other:								
No department	0	0	0	0	0	6	0	6
Other (not classified above)	0	*	*	0	*	0	*	1
Total Other	0	*	*	0	*	6	*	7
Total % in each rank	21	25	23	18	6	6	*	100

*Less than 1 per cent response.

Source: Darley, 1957, p. 184.

TABLE 3.2

TRAINING AND PRESENT POSITION OF ADMISSION COMMITTEE MEMBERS
(Participants group)

Training and present position	% of 91 schools citing proportion of admission committee members in each training category						
	None	1-10%	11-20%	21-30%	31-40%	41-50%	Over 50%
M.D. clinicians(nonpsychiatrist)	10	1	19	10	27	20	13
M.D. basic science teachers	42	8	30	9	7	2	2
Psychiatrists	52	11	34	2	1	0	0
M.D. administrative officers (deans, directors of admissions, etc.)	31	6	36	13	9	4	1
Non-M.D. basic science teachers	30	4	37	11	9	7	2
Psychologists	94	4	2	0	0	0	0
Non-M.D. administrative officers (deans, directors of admissions, etc.)	59	9	22	4	3	1	2
Premedical advisers	91	0	7	2	0	0	0
Others	91	3	6	0	0	0	0

Source: Gee and Cowles, 1957, p. 131.

TABLE 3.3

Size of Admissions Committees as Related to Number of Applications Processed for 1956 Class

Number of Members on Committee	N	Number of Applications Processed			
		250 or Less	251-1000	Over 1000	Total
	(91)	(18)	(45)	(28)	(91)
2-3	(5)	0	2	4	6
4-5	(28)	6	13	12	31
6-7	(23)	9	12	4	25
8-9	(11)	3	7	2	12
10-11	(14)	2	9	4	15
12 or more	(10)	0	6	5	11
Total	(91)	20	49	31	

Source: Gee and Cowles, 1957, p. 200.

TABLE 3.4

MEMBERSHIP ROTATION OF ADMISSIONS COMMITTEES

(Participants group)

Membership rotation	% of 36 schools*
At least some members are replaced each year	47
At least some members are replaced every two years	6
At least some members are replaced every three years	14
At least some members are replaced every four years	6
Replacement is done at the discretion of an administrative officer	8
No regular replacement plan	8
Other	11

*Of the 91 participants, this 40 per cent stated that the admissions committee at their school changed by some rotation plan.

Source: Gee and Cowles, 1957, p. 200.

TABLE 3.5

DISTRIBUTION OF WORK ACCORDING TO ADMINISTRATIVE POSITION

(Participants group)

Administrative position of participant	% of 91 participants citing proportion of time spent in various areas of activity							% of participants in each administrative position
	None	1-20%	21-40%	41-60%	61-80%	81-100%	No response	
				Work devoted to teaching				
Dean or president	9	19	1	0	0	0	0	29
Other deans	5	21	19	2	1	0	0	48
Other positions	0	2	13	7	1	0	0	23
All participants	14	42	33	9	2	0	0	100
				Work devoted to administration				
Dean or president	0	0	0	1	7	21	0	29
Other deans	0	1	13	17	5	12	0	48
Other positions	1	8	10	3	1	0	0	23
All participants	1	9	23	21	13	33	0	100
				Work devoted to patient care				
Dean or president	25	3	0	0	0	0	1	29
Other deans	33	11	2	1	0	0	1	48
Other positions	14	6	1	1	1	0	0	23
All participants	72	20	3	2	1	0	2	100
				Work devoted to research				
Dean or president	24	3	1	0	0	0	1	29
Other deans	17	21	9	0	0	0	1	48
Other positions	4	6	11	1	1	0	0	23
All participants	45	30	21	1	1	0	2	100
				Work devoted to other activities				
Dean or president	27	1	0	0	0	0	1	29
Other deans	44	2	1	0	0	0	1	48
Other positions	23	0	0	0	0	0	0	23
All participants	94	3	1	0	0	0	2	100

Source: Darley, 1957, p. 183.

TABLE 3.6

ADMISSIONS COMMITTEE OPERATION

How does your admissions committee perform its work?

Response	Per cent
Meets as a group on all applicants	65
Meets as a group on most cases	22
Meets as a group on most difficult cases	8
Other	4
No response	1
N	(91)

Source: Gee and Cowles, 1957, p. 200.

TABLE 3.7

METHODS FOR DECIDING WHICH APPLICANTS ARE INTERVIEWED.

(Participants group; multiple response)

Method for selecting interviewee	% of 91 participants
All of the most promising applicants are interviewed routinely	74
Only candidates who present special problems but who are otherwise being seriously considered for admission are interviewed	6
All candidates who request interviews are interviewed	44
Only candidates who request interviews are interviewed	2
Every candidate who eventually is offered a place in the entering class is interviewed	60
Participants who did not check any of the above methods	2
Other	13

Source: Gee and Cowles, 1957, p. 134.

TABLE 3.8

COMMENTS ON COMMITTEE'S ROLE IN DEVELOPING ADMISSIONS POLICY AND PROCEDURE

(Participants group)

Committee's role	% of 91 schools*
Committee recommends policy to executive faculty	21
Committee makes policy	13
Committee recommends policy to dean	12
Committee makes a periodic review of policy	11
Committee recommends policy to administration	10
Committee recommends to dean; dean recommends to executive faculty or to administration	8
Other method used to make policy	11
Irrelevant comment	3
No comment	11

*Of 91 participants, 100 per cent claimed that the admissions committee at their school assisted in developing admissions policy and procedure.

Source: Gee and Cowles, 1957, p. 200.

1973). The questionnaires for the Fourth Teaching Institute only asked several very broad questions concerning their manner of operation and involvement in policy making issues (Tables 3.6-3.8). This absence of more elaborate data may indicate that the workload of admissions committees was not considered a serious problem at this time.

Sixty-three percent of the respondents indicated that a special effort was made to orient or train new members of their admissions committees. Of these, 72 percent utilized the method of "briefing" the new member by experienced members or an administrative officer. Members of the committee almost always made an effort to review the results of their previous decisions, i.e., data on students who were having special difficulty or who had dropped out.

Perhaps most interesting is the data the Institute did not include. We are uninformed as to the age, sex and race of admissions committee members of the 1950's, therefore leaving unchallenged the assumption that they were almost invariably white, middle-aged males. This is in sharp contrast to the concerns of the late sixties and early seventies when the demographic composition of admissions committees became a hotly debated issue.

1960's

From the Fourth Teaching Institute up to the late 1960's, there exists an amazing void of literature concerning the admissions committees. Much attention was being given to other aspects of the admissions process, especially concerning the range of criteria used in selecting students, but there was an almost total lack of examination of the group of individuals who were responsible for selecting our future physicians. As noted earlier, Funkenstein (1970) wrote of the deplorable lack of self-examination which seemed to exist among these highly influential committees. The 1960's had brought on a vast array of social changes which carried strong implications for the nation's medical schools. The process of selecting medical students as it related to meeting the rapidly evolving needs of society was sharply scrutinized. Still, as far as can be discerned from the literature of this period, no systematic appraisal was being made in the 1960's to determine whether or not admissions committees were in fact changing with the times.

In 1969, the AAMC's Office of Minority Affairs began publishing the booklet Minority Student Opportunities in the United States Medical Schools (AAMC (DSP), 1975) which contains information on the structure or each school's admissions committee as it relates to selecting minority applicants. In the late 1960's a number of schools had begun forming special subcommittees of their admissions committee to deal with the "nontraditional" nature of many minority applications. Members of these subcommittees, were usually non-white themselves, and were cognizant of the special problems involved in appraising the applications of minority students.

Also in 1969, Frank Stritter's survey of medical school admissions and student affairs officers brought out the increasing number of students participating in admissions committees. Of those responding (143 out of 175), 30.8 percent reported that students did participate in admissions, 42.6 percent said they did not but should, and 21.1 percent said students did not and should not. This is an interesting change from the Fourth Teaching Institute's survey which did not even ask this question, apparently assuming that few if any schools had students on their admissions committe.

1970's

The adaptation of the composition and structure of medical school admissions committees may appear amazingly slow to some observers, but change does come after much thought and deliberation. Generally conservative by nature, several years may sometimes elapse between the espousal of goals set by the nation and its institutions, and the implementation of these goals into the functioning of an admissions committee.

Thus far the literature of the 1970's has demonstrated some evidence of an investigation into the issues raised from the late 1960's on, as they relate to admissions committees. Funkenstein (1970) not only criticized the current structure and operation of these committees, but also made some specific and detailed proposals for their improvement. Foremost among his suggestions is that "it is no longer possible to use current methods by which each highly qualified student's credentials are carefully scrutinized by the entire committee. In order to allay unreasonable pressures, and improve the evaluation of applicants, it is necessary to broaden the scope of the committee and involve all elements of the medical school community in admission. Representation should be given to the overall faculty, academic departments, administration, students, alumni, minority groups, women, house officers, and young faculty members . . . The admission committee would consist of two categories of members: (a) General, and (b) The Chairmen of Subcommittees for selecting students for the various programs" (p. 504).

These subcommittees would serve a twofold purpose: 1) "they would place the selection of students for special programs on the basis of the most appropriate criteria and techniques for that specific program; and 2) they would allow a continued, careful consideration of each applicant, a process no longer possible under current admissions procedures due to the increasing number of applicants" (p. 506).

Many of these suggestions were in fact implemented at Harvard with much success. In August of 1974 an Admissions Review Committee was appointed at Harvard (Cheever, et al., 1975) and over the course of the following year they carefully assessed the admissions process including a close examination of the admissions subcommittees. Recommendations for changes and alterations were made, but on the whole the system seemed to

be working. It is, however, difficult to assess how applicable this structure might be at schools other than Harvard. Nevertheless, it does demonstrate how some creative reorganization can revitalize the functioning of an admissions committee.

In 1972, Oetgen and Pepper reported on a comprehensive survey conducted the previous year of all U.S. medical school admissions officers. A questionnaire designed to elicit information about admissions committee members and the functioning of the committees was completed and returned by 73 (59 percent) of the 124 institutions polled (Canada was included).

Unlike the Fourth Teaching Institute survey, Oetgen and Pepper did collect data on the demographic characteristics of committee members. It was found that "ages of admissions committee members ranged from 21 to 67 years, the modal age being 42 (mean 41.5). Women comprised 8 percent of the committee members (63 percent of women committee members were reported to hold the M.D. degree and 25 percent held the Ph.D. degree). By race and ethnic group, the committee members were distributed as follows: Caucasian, 83 percent; Black, 5 percent; Oriental, 4 percent; Puerto Rican, 0.7 percent; Mexican-American, 0.4 percent. There were no reported American-Indian committee members. Slightly over half (55 percent) of responding schools indicated that there is at least one racial minority member on their admissions committee" (p. 966).

Eighty-eight percent of the total sample held either an M.D., Ph.D., or both degrees. The mean length of time spent as an admissions committee member was 3.1 years.

"Data on respondents' teaching department appointments or administrative positions are presented in Table 3.9*. Comparison of Table 3.9 with the data presented in the 1957 AAMC study (Table 3.10) shows many similarities, but there are some differences. For example, in the present study 52 percent of sampled admissions committee members are from the clinical science faculty and the 1957 study showed 51 percent in this category; 15 years ago deans or their assistants comprised 17 percent of admissions committee members, and department chairmen filled an additional 20 percent of the committee seats while today the deans' representation has dwindled to 5 percent and the department chairmen's to 4 percent of committee members. With respect to the teaching rank of committee members, the 1957 study indicated that 23 percent of committee members were associate professors and 18 percent were assistant professors. In the present study 24 percent of committee members hold teaching ranks of associate professor and 25 percent are assistant professors.

"In 1957 there were very few or no students on medical school admissions committees. The present survey showed that over half of the responding medical schools (56 percent) now include at least one student on their admissions committees; and in over half of these (30 percent of

*Table number changed to conform with this literature review.

TABLE 3.9

PERCENTAGE OF 853 ADMISSIONS COMMITTEE MEMBERS BY TEACHING DEPARTMENT AND ADMINISTRATIVE POSITION

Teaching Department	Dean or President	Other Deans	Department Chairmen	Other Position	None Given	Total
Clinical Science						
Medicine	0	*	*	16	0	16
Ob/Gyn	0	*	*	3	0	3
Pediatrics	*	0	*	6	0	6
Psychiatry	0	*	*	7	0	7
Preventive Medicine	0	*	*	2	0	2
Surgery	*	*	*	9	*	10
Radiology-Nuclear Medicine	0	0	*	1	0	2
Other Clinical	0	*	*	5	0	6
Total	*	1	2	49	*	52
Basic Science						
Anatomy	0	*	*	5	*	6
Microbiology	*	*	*	3	*	4
Biochemistry	0	*	*	4	0	5
Pathology	*	*	*	4	0	5
Pharmacology	0	*	*	3	0	3
Physiology	0	*	*	4	0	5
Other Basic Science	0	*	*	3	*	3
Total	*	2	2	26	*	31
Other						
Other Departments	0	0	0	1	*	1
No Answer	*	1	0	4	11	16
Total	*	1	0	5	11	17
Total	1	4	4	79	12	100

*Less than 1 percent.

Source: Oetgen and Pepper, 1972, p. 967.

TABLE 3.10

TEACHING DEPARTMENT AND ADMINISTRATIVE POSITION OF ADMISSION COMMITTEE MEMBERS

(Committee members group)

Teaching department	% of 534 committee members in each dept. according to their administrative position					Total % in each teaching dept.
	Dean or president	Other deans	Department chairman	Other	None given	
Clinical:						
Medicine	1	3	2	3	10	19
Obstetrics/Gynecology	*	*	1	0	2	3
Pediatrics	*	*	1	*	2	4
Psychiatry	0	*	1	2	3	7
Preventive Medicine	*	*	1	1	2	4
Surgery	0	*	*	2	4	7
Radiology/Radiobiology	0	*	*	*	1	1
Clinical joint appointment	0	*	0	*	1	1
Other clinical	*	*	2	*	2	5
Total Clinical	2	4	9	9	27	51
Basic Science:						
Anatomy	1	2	2	1	5	11
Microbiology	0	*	2	*	2	4
Biochemistry	*	1	3	*	4	8
Pathology	1	*	1	0	4	6
Pharmacology	*	*	1	0	2	4
Physiology	*	1	2	*	2	5
Basic science joint appointment	0	*	*	*	1	2
Other basic science	0	*	0	1	*	1
Total Basic Science	3	5	11	2	21	42
Other:						
No Department	1	2	0	3	0	6
Other(not classified above)	0	*	0	*	*	1
Total Other	1	2	0	3	*	7
Total % in each position	6	11	20	14	49	100

* Less than 1 per cent response.

Source: Darley, 1957, p. 183.

total respondents), student bodies have some voice in the selection of committee members.

"In contrast to the increased representation of medical students, the consumer community has virtually no representation on medical school admissions committees. Only two schools reported that their committees include representatives recognized as 'nonmedical, nonprofessional' members. Two other schools reported plans to appoint such members" (p. 967).

In addition to the comprehensive national analyses of admissions committees reported above, several individual medical schools have also published reports in recent years describing the composition and organization of their own admissions committees.

In a brief, applicant-oriented article, the Dean (DuVal, 1970) of the University of Arizona's College of Medicine reported that their admissions committee consisted of 10 members: 7 faculty and 3 students. Hermann and Creek (1971) of Creighton University School of Medicine described their committee as consisting of eight members who represented different medical disciplines and were equally divided among preclinical and clinical disciplines (there were also plans to begin including students as full members). Committee members met for 4-6 hours per week during peak application period (October-February). The Committee was chaired by an Associate Professor of Physiology and Pharmacology who devoted 10-15 additional hours per week checking applicants' files, noting deficiencies and undertaking preliminary screening.

The admissions committee of the University of Nebraska College of Medicine (Henn and Carver, 1971) consisted of ten members, eight of whom were faculty. Members were recommended by the Committee on Committees chaired by the Dean of the College of Medicine and were approved by the College's Executive Faculty. They consisted of faculty from basic and clinical sciences as well as volunteer faculty active in the school as well as their own practice. The Assistant Dean for Student Affairs served as both member and chairman. Student members were chosen by the Dean of the College in consultation with the Student Affairs Officer. The Committee was responsible to and made all recommendations to the Dean of the College of Medicine for his approval or disapproval. The Committee met weekly for 4-6 hours after the November 1st application deadline.

Morgan and McKee (1971) reported that the West Virginia University School of Medicine had ten faculty members and two students on its admissions committee, which was chaired by an Associate Professor of Neurology. At the University of Washington School of Medicine (Schwarz, 1972) the admissions committee consisted of three subcommittees: one screening and two interviewing. Each subcommittee was composed of a physician from private practice, a basic science faculty member, a member of the full-time clinical faculty, a student, and the admissions

officer. Usually there was also another faculty member from either the basic or clinical sciences. The screening committee reviewed the completed applications and decided who would be interviewed. The interviewing committees then took over and made the final decisions.

In 1973, the University of Oklahoma College of Medicine included representatives of the Oklahoma Academy of Family Physicians and the State Medical Association on its admissions committee. In addition, there were part-time and full-time faculty as well as nine fourth-year medical students chosen by the student body. Each applicant was interviewed by three committee members, one of whom was a student. The Review Committee, consisting of the most experienced members, did not interview but reviewed each applicant's folder and voted on it. The Chairman of this committee would then report the vote to the whole board who would make the final decision.

The Committee on Admissions at Jefferson is appointed annually by the Committee on Committees of the College. There presently are 26 members of the Committee: six from the pre-clinical faculty, 14 from the clinical faculty, two who hold appointments in both the clinical and pre-clinical faculty and the Registrar. Three students with full voting privileges also are appointed. Meetings and interviews for the following year's class begin in July and end in May, with the Committee meeting every Wednesday from 12:30 to 2:30 p.m. (Conly, 1975).

Summary

While the admissions committee is at the hub of activity in the admissions process and carries much influence, the changing patterns of its operation and membership over the past twenty years is difficult to assess because of a lack of literature dealing with it. The Fourth Teaching Institute (Gee and Cowles, 1957) produced much valuable data concerning these committees, but there is no comparable data for the 1960's and a discouragingly small amount for the 1970's.

Reports from individual medical schools, as well as a 1969 survey (Stritter), show that the student activist days of the sixties had an impact on the admissions committee by their inclusion of students, often as full voting members. In addition, AAMC's Minority Student Opportunities in the United States Medical Schools (AAMC (DSP), 1975), first published in 1969, and Oetgen and Pepper's survey (1972), demonstrate that many admissions committees have been making a serious effort to admit more minority students by forming special subcommittees and including more minority members.

Thus, there is some indication in the literature that medical school admissions committees are attempting to reorganize themselves

in order to better meet the national and institutional goals of increasing the representation of minorities and women in medical schools. The literature is sparse, however, and for the most part preconceived notions of what constitutes the "average" admissions committee and how these committees function have been less than completely examined and/or reported.

CHAPTER IV

SELECTION FACTORS AND THEIR PREDICTIVE VALIDITY

Even in 1956 it was trite to say that the selection process is essentially a problem of prediction (McConnell, 1957). While admissions continues to be a problem of prediction, the criteria being predicted have changed during the last two decades. In the 1950's and early 1960's the major concern of admissions committees was to select applicants who would successfully complete their medical training and go on to be "good" physicians. The concern was to reduce the higher rates of attrition from medical school which were characteristic of the time. By increasing the accuracy of predicting which students would and would not complete medical school, the production of physicians could be increased while the financial cost to the institutions and the psychological cost to the students could, at the same time, be decreased (Johnson and Hutchins, 1966).

While the attempt to keep attrition down continues to be an important element in the selection process, a greatly enlarged applicant pool from which to select potential medical students, the improved academic credentials of today's applicants, and pressures for the production of physicians to fill societal needs have combined to de-emphasize medical school achievement as the major criterion being predicted by the admissions process. Furthermore, there has always existed an awareness that there is not a one-to-one relationship between medical school achievement and performance as a physician.

The Criterion Problem

Actually, one of the two major changes evidenced in the literature concerning selection variables over the past twenty years has been the change in emphasis on attempting to predict the immediate objective of medical school achievement to predicting the long-term objective of physician performance. An excellent survey and evaluation of research on the measurement of physician performance by Barro (1973) points up the variety of ways to measure physician performance. The problem, then, is which of all these criteria should the admissions process attempt to predict? Gottheil and Michael (1957) in a review of the variables used in medical school admissions were neither the first nor the last to point out that:

> Presumably the goal of medical education is to produce "good" doctors of medicine. What constitutes the good doctor, however, and how to evaluate the constituent factors remains the most perplexing problem in the field. This question represents the fundamental problem basic to all others in selection. (p. 147)

At the time when attrition was a serious concern, it was logical to emphasize that in order to become a physician a student must first graduate from medical school. Thus, the admissions process was seen as an attempt to predict two types of performance, one a preface to the other: performance as a medical student and performance as a physician. To complicate matters, as McConnell (1957) pointed out, performance in neither role is unitary, since medical students must study both the basic and the clinical sciences and since physicians do many things, e.g. practice general or specialty medicine, teach, do research, etc.

With today's larger and more qualified applicant pool, it has been possible to concentrate on selecting persons, not primarily for medical school survival, but more for the practice of medicine. This new focus has gone hand in hand with the other major change seen in medical school admissions over the past twenty years, namely the attempt to select persons for the medical profession who will serve certain societal needs. These needs have been defined to include (a) greater access to medical careers for groups heretofore underrepresented in the profession, particularly women, minorities and persons from disadvantaged backgrounds, and (b) a more balanced distribution of physician manpower by specialties and practice locations. Henig (1976a), however, observes rather colloquially that "maldistribution is the profession's current rallying cry, so individuals who seem likely to choose small towns and primary care are hot items on today's medical education marketplace. But which types will medical schools be clamoring to admit next year?" Nevertheless, societal requirements can be viewed as one step toward reducing the ambiguity in the definition of a "good" physician which has plagued conscientious persons involved in the actual selection of medical students.

The intention of this discussion has been to underline the importance of defining the criteria one wishes to predict, in order to be able to search for variables which will successfully predict them. A continuing theme in the literature has been the appeal for such definition. In 1956 Darley (1957) scolded participants of AAMC's Fourth Teaching Institute, after examining their responses to the Institute's survey of admission criteria, "the variables which are of concern to you, regardless of the degree of confidence placed in them, are variables which, so far as I could tell, do not differentiate the profession of medicine from any other human creative activity" (p. 182).

Fifteen years later a survey of the 103 U.S. and Canadian medical schools then extant demonstrated that not much headway had been made in specifying the desirable characteristics of a physician (Mlott and Schachte, 1972). Only 73 schools responded to the survey and, of those, 40 responded to the question regarding the desirable characteristics of a physician. Six of the non-responding schools "made statements to the effect that the desirable attributes of a physician are 'highly variable and nobody has an answer.' The number of attributes suggested by the responding schools ranged from 1 to 18, with a mean of 3 attributes" (p. 320).

Unfortunately, the authors do not present their results in full. They report that "data tabulation revealed that unquestionable integrity is the characteristic deemed most important in a physician by 12 of the responding medical schools (30.0%). Following this, 11 schools (27.5%) emphasized motivation to follow a career in medicine, and 10 schools (25.0%) rated a continuing desire for learning and self-education important. Intelligence above average was also cited by 10 schools (25.0%), while 9 schools (22.5%) emphasized compassion, warmth, and interest in others' welfare. Slightly less frequently, characteristics such as maturity, emotional stability, and honesty (6 schools, or 15.0%) were cited. A total of 65 desirable attributes were listed by the medical schools answering this question" (pp. 320-321).

In a list of eight recommendations regarding admissions made to the medical schools by an ad hoc committee of the AAMC's Council of Deans (Green and Johnson, 1972), the first listed is that of "a better definition of admissions objectives" (p. 975).

Jarecky (1974) says "the problem, whether selection is focused on minorities, rural youth, or applicants whose characteristics may appear consonant with the eventual practice of primary care, psychiatry, or surgery, is essentially the same -- how to define those crucial elements of behavior and identify those values that tend to predict desirable physician characteristics" (p. 13).

This chapter will concentrate principally on studies concerned with the criterion of medical school performance. A few studies which focus on physician performance as a criterion are considered, principally in connection with cognitive admission factors. The literature review by Barro considers some non-cognitive characteristics related to physician performance in the section on interpersonal process approaches. But, as she points out "the bulk of the physician performance literature focuses on the technical as opposed to the interpersonal processes. Moreover, within the technical domain there tends to be heavy emphasis on the cognitive aspects of performance" (p. 1054).

Domains of Student Characteristics and Their Measures

In spite of the complexity and imprecision of the criteria which are being predicted, there are certain pieces of information about applicants which have been found to make the admissions process a significantly better-than-chance procedure. That information is usually classified into two types: one concerning the intellectual or cognitive characteristics of an applicant and the other concerning non-cognitive characteristics. Cognitive characteristics refer to both aptitude for intellectual work and the achievement of certain levels of knowledge. Non-cognitive characteristics, as the term implies, include everything other than intellectual traits and usually refer to biographic/demographic, personality and career motivation/interest factors. These, then, are the major domains into which information about applicants are usually classified in the admissions literature.

For each applicant, information on their differing characteristics is obtained from a variety of sources or measures, the major classifications of which are: cognitive test scores, college transcripts, letters of recommendation, application forms, interviews and psychological tests. Figure 1 shows the applicant characteristics domains for which the different sources provide data.

Each of the major domains can and usually are broken down into more specific categories, categories often operationally defined in terms of the instruments used to measure them. For example, while intellectual aptitude is often treated as a unitary concept, it is equally as often treated in terms of two subcategories, verbal aptitude and quantitative aptitude. In comparison, the subcategories of personality characteristics, defined both conceptually and operationally, seem, after a reading of the literature, to be almost infinite. In a similar manner, the sources of information on applicant characteristics can and usually are specified with greater precision. Interviews can be admissions or psychiatric, group or individual, etc.; transcripts include grades, credit hours completed, college attended, etc.; recommendations can be written by faculty, premedical advisors, employers, peers, etc.

While the foregoing provides some structure for considering the types and sources of information used or recommended for use in the admissions process, it is not as straightforward as it might seem at first glance. Not only does a single source of information reflect characteristics from more than a single domain, but more importantly, characteristics from different domains typically are interrelated. For example, demographic characteristics such as sex and racial identity are related to career interests; while health and biographic factors are related to achievement. Thus, McDermott et al. (1973) demonstrated a relationship between academic achievement and career motivation/interest. In their study, students with the lowest GPA's chose medicine

FIGURE 4.1

Sources of Data on Applicant Characteristics

Domains of Applicant Characteristics	Sources of Data on Characteristics					
	Cognitive Test Scores	College Transcripts	Letters of Recommendation	Application Forms	Interviews	Personality Tests
Cognitive						
Aptitude	X	X	X			
Achievement	X	X	X			
Non-Cognitive						
Biographic/ Demographic				X		
Personality			X		X	X
Career interest/ motivation			X	X	X	X

for the pragmatic motivations of financial success and status, while the more academically successful students chose medicine because of social idealism, scientific interest and interest in people. Recent major changes in the criteria recommended for the admission of non-traditional applicants and the weights assigned to those criteria were in response to efforts to remind admissions persons of the interrelationships between characteristics from the broad cognitive and non-cognitive domains, particularly of the effect of socioeconomic background on academic achievement (Elliott, 1974; D'Costa, 1974). These relationships shall be discussed in greater detail later in this chapter.

Cognitive Selection Factors

Most of the emphasis in selection until recently has focused on characteristics in the cognitive domain, both on intellectual aptitude and achievement. As was mentioned earlier, this was a result of the effort to reduce that part of medical student attrition which is due purely to academic factors.

Results from the survey conducted in connection with AAMC's Fourth Teaching Institute reported by Glaser (1957) and Ceitham1 (1957) show that, after "character and integrity," "intellectual characteristics" and "academic achievement" were considered to be the most important of fourteen applicant characteristics, the others of which were all non-cognitive. These were, also, the two characteristics which admissions committee members and institute participants felt most confident in evaluating.

The major sources of information on students' intellectual aptitudes and achievements have been the Medical College Admission Test (MCAT) and undergraduate or premedical grades. Because both provide quantitative indices of a student's abilities and knowledge, they may have been responsible for engendering the greater confidence of admission committees in evaluating intellectual characteristics. The MCAT is actually four separate tests, two of which were designed to measure aptitude and the other two to measure achievement (Sanazaro and Hutchins, 1963). The two aptitude subsections of MCAT assess verbal and quantitative aptitude; while the two achievement subsections assess science and general information knowledge.

THE MEDICAL COLLEGE ADMISSION TEST (MCAT)

Because submission of scores on the Medical College Admission Test (MCAT) has been required of applicants by virtually all medical schools in the U.S., to the almost complete exclusion of any other objective test of cognitive ability or achievement, a major part of the literature

concerned with medical school admissions focuses on the MCAT, its predictive validity and its relationship to other variables.

Many of these studies are correlational in nature, using attrition, medical school grades, faculty ratings, scores on the National Board of Medical Examiners test, internship supervisors' ratings, etc., as the criteria being predicted by scores on the MCAT. In the late 1950's and early 1960's, various researchers, after obtaining low correlations between MCAT scores and various criteria, concluded that the examination had little predictive validity (Richards and Taylor, 1961; Richards et al., 1965; Gough et al., 1963). In a review of the test, Wesman (1959) stated "the overall picture of validity provokes one to question whether the individual medical schools are (or should be) satisfied with the program" (p. 937).

This type of condemnation of the MCAT is counterbalanced by articles defending the value of the test. These articles point out various reasons for the misleadingly low correlations, including that of the admission and graduation of certain students who seem promising in spite of low MCAT scores. It was repeatedly pointed out that the "restriction of range" of the MCAT scores of medical students causes the correlation coefficients obtained in such studies to be underestimated (Gee, 1958; Schumacher, 1960; Sanazaro and Hutchins, 1963). In other words, since medical students generally have higher scores than all those who apply to medical school, the range and variability in the distribution of their scores is curtailed. This, in turn, diminishes the size of any correlation which might emerge. However, Sedlacek and Hutchins (1966a) empirically demonstrated that, in these correlational studies, it was restriction of range of the criterion (of NBME scores in their study) more than that of the predictor (MCAT) which was likely to underestimate such relationships.

Whether because of or in spite of the dampening effects of such methodological artifacts, the highest correlation coefficients obtained between MCAT scores and various criteria have not generally exceeded the .35 to .45 range, with a good many studies obtaining substantially lower coefficients. Furthermore, as Funkenstein (1966b) pointed out, in such correlational studies it is the squared correlation coefficient which gives a clearer indication of a test's predictive ability by giving the percent of variance in the criterion explained by the test. Thus, for example, a correlation of .40 only accounts for 16 percent of the variance.

Medical School Performance Operationalized As Attrition or Progress

Studies using attrition from medical school or irregular progress through medical school (but eventual graduation as the criterion) generally attest to MCAT's ability to distinguish dropouts and those with irregular progress from those with regular progress. Persons dropping out for academic reasons tend to have appreciably lower scores on the MCAT, particularly on the Quantitative and Science subtests, than do those dropping out because of non-academic reasons (AAMC (DOS), 1961; Garfield and Wolpin, 1961; Gough and Hall, 1975a; Johnson and Hutchins, 1966; Sanazaro, 1965). These studies have also demonstrated the generally high MCAT scores of those persons who drop out because of emotional problems, lack of interest in the field and other non-academic reasons (Motto and Werner, 1965a).

In a study which characterized medical schools by the degree to which their respective students made regular progress toward the M.D. (Little, Gee and Novick, 1960), it was found that, at those schools where there was a high degree of regularity, no significant relationship between students' academic irregularities and MCAT scores existed. However, at schools where progress was generally more irregular, academic irregularities were significantly related to MCAT scores. It may be that restriction in the range of academic irregularity accounted for the lack of relationship found for schools where most students made regular progress.

Bartlett (1967) examined the attrition rate, as well as class rankings, academic warnings, academic honors, internship appointments, faculty appointments and later careers of 49 students admitted to the University of Rochester with "low" MCAT Verbal and Science scores. "Low" was defined as two standard errors below the national mean for those subtests. When the low scorers were compared to other Rochester students on the characteristics listed above, the results showed no significant differences on any of the characteristics.

In one of the few studies which directly examines the predictive validity of the MCAT for different racial groups, Feitz (1974) obtained significant differences in the scores of (a) promoted students versus repeaters and dropouts and (b) repeaters versus dropouts. All of these differences were obtained both for white students and for black students examined as separate groups.

The other major study regarding MCAT's ability to predict medical school attrition or progress for different racial groups is a cooperative study by the Student National Medical Association and the AAMC (Johnson, Smith and Tarnoff, 1975). The data from that study, on the

MCAT scores of promoted and not-promoted black and white students (which are reproduced in Table 4.1), show greater differences in MCAT scores between promoted and not-promoted blacks than between promoted and not-promoted whites. Probably of even more importance than the size of these differences, however, is the relative level of test performance. Regardless of race, differences in MCAT scores in the 500's and 600's are less relevant in predicting academic performance in the basic science years of medical school than are differences in the 400's. Although no ready explanation is provided, it is interesting to note, in this table, that the Quantitative subtest scores of both black and white women who are not promoted are higher than those of the women in the same racial group who are promoted.

Medical School Performance Operationalized As Grades and Test Scores

Initially, results of those studies which have examined MCAT scores in relation to various measures of medical school achievement (such as grades, class rank and NBME scores) seem contradictory, some reporting significant positive relationships and some reporting little or no relationship. However, it is necessary to distinguish among these studies on the basis of the particular criterion measure used, i.e. grade point average (GPA) for the first year of medical school, GPA for the first two years, GPA for the last two years, GPA for all four years, class rank by year or for all four years, or scores on two of the four NBME subtests[1] which are taken at different points along the usual four-year progression from entrance to graduation from medical school.

Since the first two years of the usual medical school curriculum are heavily oriented toward academic study of the basic medical sciences, it is logical that the MCAT aptitude and particularly the science achievement subtests should show a greater relationship to grades earned in the earlier years of medical school. In fact, the original purpose of MCAT was simply that of reducing attrition in the basic sciences, of making gross discriminations between those who would and would not survive this earlier part of the curriculum. Furthermore, it was never intended to distinguish among different levels of either premedical or medical school achievement in skills of specific importance for medicine (Damrin, 1958; Erdmann, 1972; Erdmann et al., 1971; Sedlacek, 1967b).

The results of a study reported by Kelly (1957b) provide evidence for the two important points about MCAT already mentioned: (1) that it seems

[1]The successful completion of these two parts of the NBME is required by many schools as a promotion criteria. For the 1975-76 academic year, only one-fourth of the medical schools considered either Part I or II optional (AAMC, 1975c).

TABLE 4.1

MEAN SCORES ON MEDICAL COLLEGE ADMISSION TEST BY RACE, SEX, AND ACADEMIC PROGRESS OF 1970 ENTRANTS TO U.S. MEDICAL SCHOOLS

Promotion Success*	Mean MCAT Scores: Verbal Ability	Quantitative Ability	General Information	Science
Caucasian (N = 5,800)	559	616	565	566
Male	559	617	564	567
Not promoted	553	605	552	553
Promoted	559	618	564	567
Female	558	604	578	558
Not promoted	545	614	574	536
Promoted	559	604	578	559
Black (N = 390)	447	461	460	448
Male	445	462	458	448
Not promoted	420	427	438	411
Promoted	452	472	464	458
Female	467	459	468	446
Not promoted	435	483	458	443
Promoted	464	452	471	447

*Defined as immediate promotion of new entrants from first-year to second-year class. Data are given only for those subjects for whom complete information was available and thus do not reflect all of the Caucasian and black American new entrants.

Source: Johnson, Smith and Tarnoff, 1975, p. 755.

to predict levels of medical school achievement, in spite of not having been designed for that purpose and (2) that it predicts performance in the early years of medical school better than it does in the later years. The study first derived five factors or dimensions of "medical college outcome" from 32 criterion variables, 14 of which were sociometric choices or ratings by peers, 11 of grade performance by year, overall and in certain 4th year courses (also in a single 2nd year course) and 7 scores on subtests and all tests of the NBME. The factors in order of derivation were "first two years grade getting," "general achievement in medicine," "4th year grades in ob/gyn and psychiatry," "sociability," and "service orientation." The coefficient of correlation obtained between the first two factors was .81, with remaining pairs of intercorrelations ranging between +.27 and -.19. Having established the criterion measures, the study proceeded to examine the correlations between the five criteria and the 45 predictor variables, among which were scores on the MCAT. The correlations between MCAT subtest scores and the first two factors (both basically measures of GPA in the first two years) ranged from +.31 to +.41 (all significant at the .05 level or better) while those between MCAT and the third factor, "4th year grades," ranged from +.07 to -.12 (all non-significant).

A recent study by Gough and Hall (1975b) identified two uncorrelated factors which reflect the distinction between performance in the earlier and later years of medical school of students at the University of California-San Francisco. The factors were labeled "academic performance" and "clinical performance." While "the clinical performance factor, accounting for 48 percent of the communality of the matrix, was more or less unpredictable from aptitude and premedical academic achievement indices, it was marginally predictable from scales on the Adjective Check List. The academic performance factor, accounting for 31 percent of the variance among criteria, was forecast with acceptable accuracy (cross-validated R = 0.43) by equations based on the Medical College Admission Test and premedical grade point average" (p. 301). In an earlier study, the same authors (1964) found similar results, a non-significant correlation between first-year and fourth-year medical school GPA and a greater degree of correlation between MCAT and early medical school achievement.

Hoffman, Wing and Leif (1963) came to the same conclusion, after deriving separate sets of multiple regression equations to predict the four criteria of yearly grade point average in medical school. They studied twelve classes of Tulane students (graduated from 1951 to 1962) using eight predictor variables: scores on the four MCAT subtests, premedical overall and science grades and two personal interview ratings. "The results of this study indicate that there is only a slight relationship existing between grades obtained during the clinical years and either pre-admissions data or medical school grades obtained during the first two years" (p. 856). Further, the number of classes for which a regression coefficient significant at the .05 level was obtained between MCAT-Science and grade average dropped from 7 for first-year

grade average to 1 for fourth-year grade average; for MCAT-Quantitative Aptitude the drop was from 8 to 0. The Verbal Aptitude and Modern Society (or General Information) subtests of the MCAT had only 1 or 2 significant coefficients across all four years.

In a study of early medical school achievement, Lief, Lief and Young (1965) found that the MCAT scores of the ten first-year students with the highest "scholastic ranking" at Tulane were significantly higher than those of the ten students with the lowest ranking. Gamble, et al. (1975), however, in a study attempting to predict scores on NBME-I and a comprehensive exam given at the conclusion of the basic medical sciences instruction program at Urbana-Illinois, concluded that there existed "very limited relationships between the sub-scores on the MCAT and the premedical and medical school performance criteria" (p. 250).

In a study which factored first and second year grades of University of Kentucky medical students in all courses into five separate components, Haley (1973) demonstrated that using GPA as a criterion "masks the effectiveness of the MCAT in predicting performance. For the group used in this study, the multiple correlations between MCAT and GPA were not significant. But when grades were separated into relatively pure components, the MCAT correlated significantly with two of the five factors" (p. 100).

While each of the MCAT subtests correlated significantly (though at a low level, .23 to .32) with one of the factors in Haley's study, various other studies have found that the Science subtest in particular has greater predictive validity than do the other subtests. Crowder (1959), for example, found that the Science subtest correlated .39 with first year grades, while the corresponding correlation for the other subtests ranged from .09 to .21. Stefanu (1971) found that the Science subtest correlated significantly and rather well (r = .46) with first-year grades but only for a group of 97 University of Alabama students who had high premedical CPA's (college credit point average). For the group of 69 students with low CPA's the correlation was nil (r = .003). Weinberg and Rooney (1973) felt that the lower MCAT-Science scores of women were predictive of their lower scores on NBME-I. They reach this conclusion by comparing national mean scores rather than by correlating individual scores. (By the time NBME-II was taken, the performance of women was on a par with that of men.)

Ingersoll and Graves (1965) found that the Science subtest was a significant predictor of first-year medical school achievement for those in an experimental curriculum at the Ohio State University Medical School while the Quantitative subtest predicted the achievement of those in their traditional curriculum. In correlating MCAT scores with class rankings for 2 classes from each of 12 schools, Peterson, Lyden, Geiger

and Colton (1963) obtained correlations all less than .35, with the few significant ones being for the Science subtest.

In spite of the apparently greater predictive ability of the Science subtest as compared to that of the other MCAT subtests, Funkenstein (1966b) and Morris (1966) expressed reservations about its utility for accurately measuring science achievement. The points made by Funkenstein were that, besides the usual limitations of any achievement test, the MCAT-Science test suffers from the following problems:

> 1. The relative amounts of biology, chemistry, and physics which contribute to the total test score are unknown to admission committees.
>
> 2. There are difficulties in keeping the test up to date because of the rapid changes in college science courses.
>
> 3. The effect which review has on the test score is unknown.
>
> 4. The effect which recency of study of the premedical sciences has on the test score is unknown. (p. 124)

Morris' objection, that it is more an aptitude than an achievement test, was based on his findings of high correlations between the Science subtest and the Verbal and Quantitative Aptitude subtests for all those taking the MCAT at both 1964 administrations. In a subsequent study (1967) on the interpretation of the MCAT Science subtest scores of repeaters, he again found a high degree of correspondence between the Science subtest and the Verbal and Quantitative Aptitude subtests. Additional findings of this second study were that 60 percent of students taking the MCAT Science subtest for a second time can expect to increase their scores; that the expected improvement would be about 25 points (possible scores on all MCAT subtests range from 200 to 800); that students completing science courses between testings improve their scores (by about 10 points); that the "true" score which admissions committees should use is the repeat test scores; and that students who felt familiarity with the test would help them did obtain somewhat greater increases than those who did not.

In connection with the issue of retesting, Schumacher and Gee (1961) found that retest gains differ by students' ability levels. Though all repeaters made significant gains, low ability students gained more on the Verbal and Quantitative subtests, while high ability students gained more on the Science subtest. The authors felt that these findings

provided support for the Verbal and Quantitative subtests as measures of scholastic potential and the Science subtest as a measure of achievement.

In concluding this examination of MCAT's ability to predict medical school performance as measured by grades and test scores, it is necessary to point out that the clinical orientation of the final two years of medical school curriculum makes it unlikely that the cognitive abilities and academic knowledge measured by MCAT could alone predict achievement in those years. Nevertheless, Korman et al. (1968) did find that high MCAT scores along with high premedical GPA were significantly related to a statistical factor of achievement in clinical medicine for 62 students at the University of Texas Southwestern Medical School. The highest loading variables on the clinical achievement factor were total GPA, third year GPA and fourth year GPA, although faculty ratings of "physicianship," peer ratings on 12 variables and internship ratings by supervisors were also entered into the factor analyses. (The only other factor of the five derived in this analysis which was significantly related to MCAT and premedical GPA was that of "Scientist Potential (SP) -- likely to accept salaried position, suitable as researcher and teacher, interested in diagnosis versus treatment" (p. 406).)

The results obtained by Turner, Helper and Kriska (1974) in their study of the predictors of clinical performance are more typical of the usual low relationship between MCAT and clinical/last two years of medical school performance. Of the four subtests, only the Science subtest had any relationship to the composite ratings of the clinical skills of third-year students at Ohio State and that relationship was negative ($r = -.28$).

The MCAT and Physician Performance

Studies of cognitive pre-admission predictors of physician performance are few in number, compared to those relating the same cognitive predictors to the short-term criterion of medical school performance. This sparsity reflects the diminished importance of such predictors for physician performance and the greater weighting of such components as technical competence and interpersonal skills. While the influence of cognitive abilities is not unimportant, the homogeneously high level of this characteristic in the physician population (because of the weight of this predictor in the selection process for medical school) necessitates an emphasis on other variables in distinguishing between "good" and "not so good" physicians. These other variables, as mentioned above, are concerned with technical skill and knowledge and with patient interation (Barro, 1973). Speaking at the First Combined GME-GSA Meeting which was devoted to the subject of physician

performance, Tuttle (1972) confessed that neither he nor anyone else really knew what the implications of physician performance were for admissions and called for more research on the subject.

Those studies which have related MCAT scores to physician performance have generally found little association between the two. This is quite likely due to the same "restriction-of-range" problem mentioned above in regards to the distribution of physicians' cognitive abilities and also mentioned previously in connection with correlational studies of MCAT and medical school performance. The problem, however, becomes even more acute when the groups being examined consist of physicians rather than medical students. The former group excludes those students who dropped out of medical school; and, as has been reported, those who drop out for academic reasons have lower MCAT scores. On the other hand, students dropping out for non-academic reasons have higher than average MCAT scores (Motto and Werner, 1965a; Gough and Hall, 1975a), are more likely to be readmitted, to ultimately graduate and to become members of the physician group.

Another probable reason for the generally low association found to exist between MCAT and physician performance also parallels that which explains the low association between MCAT and performance in the later or clinical years of medical school, namely that MCAT was not designed for the prediction of clinical competence. As clinical competence becomes an increasingly important factor in the criterion being predicted, MCAT becomes a decreasingly relevant predictor.

An early study of physician performance which includes MCAT as a predictor is that conducted by Peterson, Andrews, Spain and Greenberg (1956). Eighty-eight physicians in general practice in North Carolina were observed and rated on six dimensions of technical process. MCAT scores were available for 30 persons and, when compared to the ratings, showed no relationship to quality of medical practice.

An unpublished doctoral dissertation (Howell, 1965) reported by Gough (1967) and a published study by the dissertation author and a colleague (Howell and Vincent, 1967) examined the relationship of MCAT to favorable and unfavorable supervisor ratings for U.S. Public Health Service Corps career officers. In the dissertation study, two groups of physicians, matched on age, specialty, geographic region, type of assignment and year in which the M:D. was received, were identified on the basis of highly favorable or unfavorable spontaneous supervisor ratings in their personnel files. There were 156 physicians in each group, with MCAT data available for 91 of the highly rated group and for 89 of the poorly rated group. Gough summarized the results as follows: "On three of the MCAT subtests the differences were in favor of the physicians with unfavorable ratings; that is, those officers scored higher on the Verbal Ability, General Information, and Science subtests.

On the Quantitative Ability subtest the mean score for the physicians receiving high ratings was 548 versus a mean of 538 for the contrasting sample. In analyses of other intellectual measures, Howell obtained similar results; that is, these variables did not yield strong differentiations between the higher-rated and lower-rated samples.

In the later study (Howell and Vincent, 1967), two criteria of physician performance were used, annual supervisory ratings on the Commissioned Officers' Efficiency and Progress Report (COEPR) and scores on a professional achievement examination in medicine, the Medical Reserve Examination, Form 2 (MRE-2). COEPR yields 4 scores based on 3 sections of the report and a score for the average of the 3. The sections are: "Section II - 8 forced-choice tetrads scored by an empirically developed key; Section III - 11 10-point rating scales for evaluating various personal and work characteristics; and Section V - a 10-point rating scale for evaluating overall performance" (p. 1039). MRE-2 also yields 3 subscores and a total, rather than an average, score. The three MRE-2 subscores are for: Medical Sciences, Clinical Medicine, and Preventive Medicine and Public Health.

The strikingly different results obtained in this single study point up the differential predictive validity of MCAT, namely that it distinguishes levels of knowledge or "book learning," but not levels of clinical or "bedside" competence. All correlations between MCAT and the COEPR scores of performance were in the negative direction ranging in absolute size from .05 to .25 (n = 123). The coefficients for the relationship between COEPR Section II and MCAT subtests VA and GI (or MS), although small in size, were significant at the .01 level. The correlations between average COEPR score and the same MCAT subtests were significant at the .05 level as was the correlation between COEPR Section III and MCAT-VA. The correlations obtained between MCAT and the MRE-2 test of academic knowledge indicate an entirely different situation. They ranged from -.05 to +.62 (n = 54), with 10 of the 16 coefficients significant at the .01 level. Furthermore, four of the six nonsignificant correlations were those between the MCAT subtests and the Clinical Medicine subtest. That this particular subtest must include a large component of clinical performance is confirmed by the four significant correlations between it and the COEPR scores of performance (r's = .31 to .38). None of the other three MRE-2 scores, those for Medical Sciences, Clinical Medicine or total score, are as highly (or significantly) correlated with any of the COEPR scores (r's = -.11 to +.14).

In a volume which summarizes "two decades of intermittently sustained research" at the University of Utah on the "measurement and predictors of physician performance" (Price et al., 1971), data are presented which reaffirm the lack of association between the MCAT and physician performance. A major part of their work was concerned with developing a method of measuring physician performance using

an unique approach which Barro could classify as neither process nor outcome. By querying physicians, other health professionals and patients regarding the qualities of a superior physician, they identified 80 factors and the respective weighting of each factor. Fifty-four rating scales were constructed to measure these factors and their reliability determined. Three statistical methods of combining the 54 ratings were also devised, yielding a total of 57 measures of physician performance. Scores on these 57 measures were correlated for 31 physicians with their scores on the Professional Aptitude Test (PAT) taken 19 years earlier. PAT, the precursor of the present MCAT, consisted of 7 subscales, four of which are identical in content and structure to the present MCAT. In addition to PAT, another measure of cognitive aptitude (and motor abilities), the General Aptitude Test Battery (GATB) was correlated with PAT/MCAT. GATB contains 11 subscales, 4 related to general intelligence, logical, verbal and numerical aptitudes and the other 7 to perception and physical dexterity.

Of the resulting 1,026 correlation coefficients, only 55 were significant at the .05 level, "almost the exact number of correlations that would be expected to occur if chance were operating in the absence of any valid trends between predictor and criterion variables" (p. 124). The only two criteria predicted consistently by 3 or more of the PAT/MCAT subscales were "number of articles in professional journals reviewed in detail each month" and "number of scientific and professional courses taken during career." The former criterion was positively related and the latter negatively related to PAT/MCAT. The conclusion was that "these findings point out the necessity of using criteria based on actual on-the-job performance rather than those derived from school performance (i.e., grades and examination scores) to validate professional selection and training procedures" (pp. 127-8).

The MCAT and Other Considerations

In addition to the question of whether the MCAT has any utility for predicting either medical school or physician performance, other questions arise. One which has been increasingly asked is that of whether the use of MCAT is valid for students from minority or disadvantaged backgrounds. Two recent studies directed toward this question came to conflicting conclusions.

Weymouth and Wergin (1976) reported on two experimental programs at the Medical College of Virginia, a Summer Institute and a Special Track, which were designed to give academic support and curriculum flexibility to students with academic difficulties. Eight of the eleven students in the first Summer Institute were black, and only one of the eleven was not eventually promoted to the second year. To determine whether the institute had enhanced the students' academic performances beyond that expected at matriculation, the regression of

first-year comprehensive examination scores on premed GPA's and MCAT scores was computed. While the equation itself or the beta weights for each predictor were not reported, the authors conclude that "there was no objective evidence to indicate that students' participation in the institute significantly affected their academic standing" (p. 669). They go on to say that "these data confirm Evans' findings that the matriculant's grade-point average and MCAT scores are rather poor predictors of academic performance in the first years of medicine" (p. 669).

However, Evans et al. (1975) conducted a similar regression analysis, using premed GPA's, MCAT scores and an index of undergraduate college selectivity as predictors of the interim exam and final Comprehensive Exam (CE) scores in the first year, and interim exam and NBME-1 scores in the second year for 43 minority students. It was concluded that "the MCAT and GPA do have some predictive validity for likelihood of passing the interim examinations and the CE at CWRUSM" (Case Western Reserve University School of Medicine) (p. 938), although the criterion with the greatest predictability was the selectivity of the undergraduate college attended.

Studies concerned with the effect of socioeconomic class on MCAT scores are especially relevant to the issue of MCAT's validity for minorities; since it is the educational and intellectual background associated with the particular levels of social class characteristic of racial/ethnic minority groups which is pertinent, rather than membership in those racial/ethnic groups per se. Thus, students from the majority, white racial/ethnic groups but from the disadvantaged or lower socioeconomic level of that group can legitimately be classified as minorities. Similarly, upper and upper-middle class students of minority racial/ethnic groups would not be considered minority or disadvantaged for the purposes of validating standardized tests. That their racial/ethnic identity is ultimately an important factor in the delivery of professional services is another matter.

A study by Woods et al. (1967) directly addresses the question of whether MCAT scores vary by social class. Students at the University of Virginia Medical School (whose minority statuses were not reported) were grouped into three levels of social class on the basis of 3 indices derived from either 3, 4 or 7 of the following variables: parents' occupations, educations and income, type of high school attended, early environs and number of books in the home. The results showed statistically significant differences (at the .01 level) for four of five MCAT scores (the 4 subtest scores and an overall average score) between students in the upper and lower social classes when grouped according to the 7 and 4 variable indices. Three of the five MCAT scores showed significant differences when students were grouped using the three variable index, but only at the .05 level.

Fredericks and Mundy (1967a) also examined the MCAT scores of a similarly-sized sample of Loyola medical students (n = 82, 80 of whom were white) in relation to an index of social class based on father's occupation and education. They found just the contrary, no statistically significant difference in any of the 4 MCAT scores among their three social class groupings of students. They also found "no relationship between the subjects' average MCAT scores and their academic achievement (in medical school) within any of the 3 social classes" (p. 132).

Results obtained by Dagenais and Rosinski (1975) over a period of ten years at the University of California, San Francisco on a much larger group (n = 497) also fall on the side of no social class differences in MCAT performance. Students were assigned to 7 social class levels using an Index of Status Characteristics. "The main classifer of status level was father's occupation, but this was moderated in some cases by total family income where subjects were assigned one level higher or lower according to size of family income" (p. 200). The authors conclude "that there are no detectable social class level differences for this sample of medical students..." (p. 204).

What is so striking about their findings is the lack of any social class difference, across the board, on any of the various cognitive and non-cognitive measures used in their research, except for the single one of undergraduate grade point average. It may be that the index of social class used is not discriminatory, based as it is on essentially one variable. In the Woods study, fewer significant differences were obtained and the level of significance declined (dropping from the .01 to the .05 level), as the number of variables in the social class index decreased. Thus, Fredericks and Mundy, using an index of social class based on only two variables, did not find any differences, nor did Dagenais and Rosinski with a single-variable index of social class.

Not only are variables in the cognitive domain, as measured here by MCAT, related to variables in the biographic/demographic domain (such as racial/ethnic identity and social class), but it has been shown that they are related to variables in the personality and career motivation/interest domains. In a study of 991 students who were entering six representative medical schools, Haley et al. (1971) examined MCAT scores and a statistically-derived factor based on MCAT scores in relation to personality measures and biographic variables. Grouping the students into high, middle and low scorers and examining differences among the groups, they found that high MCAT scorers were less conforming, less religious, less dogmatic, less economically oriented and more independent and embracing of aesthetic values than were middle scorers. Similarly middle scorers possessed these characteristics to a greater extent than did low scorers.

Significant differences among the three levels of MCAT scorers were also obtained in the biographic variables. Of those deciding to enter and actually entering medical school at younger- and older-than average ages, a greater percentage were high MCAT scorers. The same was true of those having majored as an undergraduate in mathematics and the humanities, those primarily interested in the research aspect of medical education, those desiring a career in research/teaching and those interested in a psychiatric or other/undecided specialty. A greater proportion of those using supplementary reading and other sources of medical information also were high MCAT scorers. The authors conclude that the relationship shown to exist between MCAT and personality and biographic variables may mean either or both of two things. "On one hand, it may mean that some or all of the MCAT scores of individuals may be affected by factors other than those the MCAT purports to measure." "On the other hand it may also mean that all or some of the MCAT subtests actually are measuring some of these other variables as well as intellectual ability and achievement" (p. 957). The difference, if any, between these two possibilities is not obvious; essentially they boil down to the point that non-cognitive components may be included in MCAT scores.

Two studies (Horowitz, 1964; Horowitz and Williams, 1964) of high and low scorers on the Omnibus Personality Inventory (OPI) scales of intellectual disposition or cognitive style obtained significant differences in MCAT scores. The studies, conducted at Western Reserve University, found 8 low, but significant positive correlations between the four OPI and the four MCAT subscores. The OPI subscales are Thinking Introversion, Theoretical Orientation, Estheticism and Complexity. Thus, high MCAT scorers can be characterized as liking abstract thought, being interested in scientific matters (including use of the scientific method of thinking), being interested in artistic matters and being flexible in thought, tolerant of ambiguities and aware of subtleties.

Along this line, Sanazaro (1965), reporting on the AAMC Longitudinal Study, found that the correlation between scores on the MCAT Science subtest and senior medical students' career plans for general practice yielded a coefficient of -.84, while that with career plans for research/teaching yielded a value of +.79. Apparently, a scientifically-oriented cognitive style, whether evidenced as OPI score or career plan, enhances performance on the MCAT.

A "New MCAT^{SM}"

Various researchers in medical student selection have, over the years, noted in passing the deficiencies of the MCAT. The most penetrating criticisms have been those of Gough, Hall and Harris (1963) and

Funkenstein (1965, 1966a). On the other hand, Sanazaro and Hutchins (1963), Grant and Bennett (1968), Elliott (1969b), and, yes, Funkenstein (1965) have pointed out that the MCAT has value when employed in the manner intended. The test is used properly (1) along with other indicators of a student's potential for medical school, (2) for the assessment of general levels of ability and knowledge in certain areas, (3) for the assessment of whether a student can (not will) meet the intellectual demands of medical school, and (4) for use with large groups to select out those at the top and bottom of the distribution. It is used improperly (1) to assess motivation, (2) to make decisions between students with small difference in scores, (3) as a measure of clinical judgement and professional competence, (4) as a single averaged score and (5) when applied to individual schools (Elliott, 1969b).

In 1971, Erdmann et al. reviewed the evolution and performance of the MCAT up until that time and described the issues relevant to possible modifications of the examination, given its inadequacies. They reported that:

> One possible change under consideration for the future is that MCAT examinees may not be required to take the Verbal and Quantitative subtests if they have recently taken one or more tests in other contexts which measure essentially the same abilities... Other questions, and perhaps more important ones, deal with the objectives of the MCAT. Are test results to serve the purpose of evaluating past learning or predicting future performance? Or are both functions desired and, if so, to what degree? (p. 944)

In an editorial the following year, Erdmann (1972) considers "the dangers of using a device which has enjoyed some measure of earlier success to meets the new challenge of changing needs and circumstances?" (p. 747) and announces a new AAMC program to assess the entire admission process, and especially the MCAT. Recommendations which had already evolved by the time of the announcement referred to "the development of achievement tests in the behavioral and social sciences; the development of a biographical inventory broadly defined to include other noncognitive (affective) dimensions; the design and development of an educational program for the users of the test; a general exploration of the various systems of performance reporting, particularly criterion-referenced measures; and the development of materials related to the cognitive and noncognitive aspects of clinical performance, including manpower distribution" (p. 748).

Following upon the decision to undertake such a program, AAMC sponsored regional conferences to develop guidelines for what was entitled the Medical College Admissions Assessment Program (MCAAP).

Position papers were prepared by each group represented at the regional conferences (AAMC (DEMR), 1973a). For the benefit of members of the MCAAP Task Force, these papers were summarized into a single volume (AAMC (DEMR), 1973b) and supplemented by individual papers and by position papers from the AAMC's Committee on the Measurement of Personality and from the Ad Hoc Committee for Minority Concerns in MCAAP. A short-term contract was awarded to the American College Testing Program (ACT) in 1973 "for development of specifications for a new assessment program" (ibid, p. 59).

In March 1976, a report to the Group on Medical Education updated progress on the "various projects now in progress through MCAAP" (AAMC, 1976e):

> The revised Medical College Admissions Tests will be offered for the first time in Spring, 1977. Admissions officers in each region have voted the following resolution:
>
> All students planning to enter medical school in 1978 must present to admissions committees scores from the new cognitive test which will replace the MCAT in the Spring of 1977 (p. 1).

The "New MCAT^{SM}" will report six scores for each examinee:

1. Skills Analysis: Reading
2. Skills Analysis: Quantitative
3. Biology
4. Chemistry
5. Physics
6. Science Problems

(Scores for each of these three areas combine assessment of both knowledge and problem solving. (combines problems from the three science areas).

A test manual, work exercises for students, an interpretative manual and a technical manual, all relating to the new test, are in preparation, as are workshops and additional supporting materials.

Validational studies, based on national samples, are planned as an integral part of the MCAAP program. The provision for such research should yield an evaluation of the new test which is more focused and coordinated than that of the old test.

PREMEDICAL GRADE POINT AVERAGE (GPA)

In addition to the MCAT, the other major cognitive measure used in medical school selection is an index of the student's academic achievement in his/her undergraduate or premedical education career. In recent years,

the AMCAS form has reported 21 to 42 differently computed GPA indices to the participating medical schools (for the academic year 1976-77, 86 of the 116 U.S. medical schools were AMCAS participants).

GPA's are computed by the applicant by subject area: one for courses in biology, chemistry, physics and mathematics (BCPM); one for courses in all other subjects (AO); and one for all courses, both BCPM and AO. These three GPA's are calculated for (a) each of the four years of college, (b) the total of all years of college, (c) post-baccalaureate but not graduate work, and (d) graduate work. Thus, up to 21 different GPA's are calculated on the basis of course grades as reported on the official school transcript. When necessary, these 21 GPA's are converted to the common AMCAS 4-point grading scale of A=4, B=3, etc. and, then, 42 different GPA's are reported.

The GPA's which have been used in predictive studies are generally those of overall GPA, overall science GPA, or overall GPA for the last two years of college. Results of these studies generally parallel the results obtained in the studies of the predictive validity of the MCAT -- namely, the further along the medical education/career continum is the criterion being predicted, the less predictive is premedical GPA. But, in spite of this decline in prediction with increasing remoteness from the point of medical school admission, the research examining the predictive validity of GPA generally indicates its superiority to the MCAT and to other tests in forecasting medical school performance at whatever point along the continum.

It is felt that one of the reasons for GPA's greater predictive ability stems from its reflection of student characteristics from both the intellectual achievement and personality domains. A "paper-and-pencil" achievement test such as the science or general information subtests of the MCAT cannot measure, in one or two sittings, qualities of perseverance and sustained performance which, many say, are even more important for success in medical school than intellectual aptitude alone.

GPA and Medical School Performance

Medical School Performance Operationalized As Attrition or Progress

The first years of medical school are probably those which most require these personal qualities of persistence and steadfastness, since the basic science curriculum has less intrinsic motivation for most students than does the clinical curriculum. Furthermore, since the academic emphasis of these early years is quite similar to the academic nature of the premedical curriculum, it is logical that GPA is a better predictor than is the MCAT.

While Johnson and Hutchins (1966) found some national differences in the MCAT scores of academic dropouts and students with regular progress, the differences were significant at the .05 level between these two groups in the percentages who were in the upper 25 percent, upper 15, upper 5 and upper 2 percent with respect to their academic rank in college. In contrast, nonacademic dropouts differed significantly from students with regular progress only in the number of those in the upper 25 percent, with 82 percent of the former and 74 percent of the latter having been in the top quarter of their college classes.

Similarly, Gough, Hall and Harris (1975a) obtained correlations significant at the .05 and .01 level between GPA during "last two terms," "science courses" GPA, and a gradient of medical school progress at the University of California-San Francisco which gave "a value of 4 to graduation, 3 to nonacademic withdrawal, and 1 to an academic dropout" (p. 945). However, as the authors themselves point out regarding the extremely low coefficients (+.06 and +.08), "they would be of almost no value in making forecasts for individuals" (p. 945).

Motto and Werner (1965a) considered that "of special concern (to their study) is differentiating between Dropouts and Highs, who in our sample are most alike in Medical College Admission Test scores, overall premedical grades and science grade-point averages" (p. 899). A major flaw of their study, though, is the failure to distinguish between academic and nonacademic dropouts which, in combination with a possible greater representation of the latter, is most likely responsible for the obtained similarity of dropouts to high medical school achievers.

Medical School Performance Operationalized As Grades and Test Scores

Because it seems intuitively logical to compare premedical grades with medical school grades and because both provide data which permit the calculation of correlation coefficients, there have been many studies of this type. The magnitude of the coefficients obtained in these studies has been higher than that obtained in studies of the relationship between MCAT and medical school grades.

Crowder (1959), for example, obtained correlations ranging from +.09 to +.39 between the four MCAT subtests and first year medical school grades at the Medical College of Georgia as was mentioned in an earlier section of this paper. Correlations between overall and science GPA and medical school grades, in the same study, yielded coefficients of +.45 and +.47, respectively. By comparing the squared coefficients, it can be seen that GPA explains approximately 7% more of the variance in grades than does the best MCAT subtest predictor (the Science subtest). Compared to the least predictive MCAT subtest, GPA explains 21% more of the grade variance, a not inconsiderable increment.

In the study by Kelly (1957b) at the University of Michigan cited earlier, the correlations between MCAT and the two factors of medical school achievement (which were derived principally from medical school grades and NBME test scores) did not exceed +.41, while that between overall and science GPA and the two factors ranged from +.49 to +.59. This represents an increase in grade variance explained of 18%. The two factors were achievement in the first two years and general achievement. The third factor of medical school achievement derived in this study, which was labeled 4th year achievement, correlated -.05 and +.01 with science and overall GPA and -.12 to +.01 with MCAT subtests.

Various other studies have supported the predictive validity of premedical grades as evidenced by Gottheil & Michael's (1957) comprehensive review of predictor variables, which concluded that premed grades were the best single predictor of medical school grades. In an unpublished dissertation conducted at the University of Southern California, Brading (1971) investigated the relationship between success in medical school (first 2 years' GPA, last two years' GPA, total four years' GPA, NBME Part I score and intern rating) and selected academic and nonacademic prediction factors. The data indicated that overall undergraduate GPA was the best single predictor of medical school GPA's.

Buehler and Trainer (1962) found that, of 22 students graduating over the years in the top 10% of their class (High Achievers) at the University of Oregon, 21 had one of the ten highest GPA's in their entering classes (Top Selection). "Of the 25 Low Achiever groups, all but two are from the Bottom Selection Group. One may conclude, almost without exception, that good premedical students are good medical students; and perhaps almost as important, that whereas the poorer premedical students are not, on the whole, as good, 20 percent of them will graduate in the top half of their class, while 10 percent of the upper groups will graduate in the bottom half" (p. 16).

Gamble et al. (1975) conclude that "the data of this study definitely give support to the use of the premedical GPA in selecting the best performers in medical school at the basic science level." Scores on the NBME Part I and a comprehensive examination on the basic sciences were the performance measure in this study done at the University of Illinois-Urbana. Calkins, et al. (1976) at the University of Missouri-Kansas City found the most significant predictor of medical school GPA to be "prior academic performance." Other studies with similar findings are those by Hoffman, Wing and Lief, 1963; Hill, 1959; Gough, Hall and Harris, 1963; Gough and Hall, 1964, 1975a, 1975b; Korman, et al., 1968; and Richards & Taylor, 1961.

Studies on the other side of the ledger (i.e. of the lack of predictive validity of premedical grades) have been few in number and not wholly negative. Roemer (1965), in a nine year validity study of

predictors of medical school success, concluded that neither MCAT scores nor GPA, either singly or in combination, are satisfactory for selection, though GPA was a better predictor than was MCAT.

Similarly, Scott and Flora (1974) found that "there was a suggestion of a parallel increase in grade point average, National Board scores, and clinical clerkship grades. In a correlation analysis, however, there was not correlation enough to make these of predictive value." Their study was based on the performance of 335 students at the Medical College of Virginia. In a study of 1,088 University of California-San Francisco medical students, Gough (1967) comes to the same conclusion, that although premedical and medical school grades correlate, the degree of association between the two is not enough to justify using only grades as a predictor.

GPA and Physician Performance

In a search of the literature for the period 1955-72, Wingard and Williamson (1973) were able to discover only 27 articles relating medical school grades to subsequent career performance. The number of articles relating premedical grades to physician performance is much smaller, perhaps in implicit recognition of the lack of fruitfulness in this line of research. Wingard and Williamson summarize the results of the research they did manage to discover as follows: "That which was reviewed is consistent in indicating little or no correlation between the factors" (of premed grades and physician performance) (p. 311). Since premedical grades are one step further removed from the criterion of physician performance, it is not unwarranted to expect even less prediction of physician performance from them than from medical school grades.

In his review of the unpublished dissertation by Howell, in which the characteristics of USPHS physicians with favorable and unfavorable supervisors' ratings were compared, Gough (1967) says "In analyses of other intellectual measures, Howell obtained similar results; that is, these variables did not yield strong differentiations between the higher-rated and lower-rated samples."

Predictor Study III of the Price-Taylor (1971) research is devoted to "the use of biographical information to predict a profile of composite medical performance scores" (p. 139). Three GPA indices (undergraduate, first two years of medical school and last two years of medical school) are considered criterion measures of performance and are correlated with 15 other such criteria. Among the other criteria are patient care, financial success, folder rating by a medical expert, and success-recognition. Of the non-GPA criteria, undergraduate GPA correlates most highly with output composite score ($r = +.21$) and years of post-M.D. experience ($r = +.20$). The correlations are based on a total of 333 faculty, specialist and general practitioner physicians in the state of Utah.

In connection with the issue of GPA as a predictor of medical school, rather than of physician, performance it is interesting to note that the correlation, in the Utah study, between undergraduate GPA and first 2 years of medical school GPA yielded a coefficient of +.65 and that with the last 2 years' GPA was +.62. Furthermore, the coefficient obtained when the two medical school GPA's were intercorrelated was +.72. These results are in marked contrast to the findings of most other studies as described earlier, in which the discontinuity between early and late medical school performance has been demonstrated, as has a much smaller degree of association between undergraduate and medical school GPA's.

GPA and Other Considerations

There is nothing inherent in grades and in the construction of grade-point averages which can discriminate against racial/ethnic or social class groups, as might be the case with standardized tests, but there are certain factors which must be considered in their use and interpretation. Principal among these considerations is that of the institution awarding the grades, including its general reputation and its grading standards. Clapp and Reid (1976) demonstrated that, when premedical science GPA was corrected by institutional selectivity, the prediction of scores on a University of Missouri comprehensive examination and on the NBME-Part I significantly increased. This was also true of the prediction of instructors' ratings.

The findings of Hill and Heck (1960) were similar and were tempered by a caution that, though an adjusted average might be used as a factor in denying an applicant admission, an institution's grading standards should not be used to reject all applicants from that institution.

The findings of Evans et al. (1975) endorse the high predictive validity of selectivity of undergraduate institution. They examined traditional criteria as predictors of the success of 43 minority students at Case Western Reserve in passing first and second year interim exams, a first year comprehensive exam and NBME-Part I at the end of the second year. The traditional criteria were MCAT scores, science and non-science GPA and selectivity of the undergraduate institution as rated by "Astin score." Regression analyses based on each of the 4 examination criteria showed that the Astin score was consistently the best predictor of exam performance (at the .01 level for the first year criteria and at the .05 level for the second year criteria). In addition to Astin score, GPA significantly contributed (at the .05 level) to predicting performance on the first year interim exams, while MCAT did so for first year comprehensive exam success. Performance on the first year interim exam also contributed significantly (at the .01 level) to predicting first year comprehensive exam success. Similarly, performance on the earlier

exam was significant ($p < .05$) in predicting second year interim exam success. Astin score was the only significant predictor of NBME-I success or failure.

Another qualification which must be considered in the interpretation of grades and GPA's is that of the particular subjects for which the grades have been received and the level of work (i.e., whether introductory, intermediate or advanced) in the course for which the grade was assigned. It has been pointed out that grades for course work in the more difficult subjects and at more advanced levels should not be weighed in the same manner as those for less demanding work. Anderson and Gamble (1974) contend that the loosening of science course requirements by the medical schools has encouraged students to take the easier courses. (For an examination of changes in course requirements, see Littlemeyer, 1969.) Similarly, the averaging of grades in subject clusters, for example science GPA, should allow for the recognition that such indices are based on a different number of credit hours for each student. The greater the number of hours upon which the index is based, the more accurate is the assessment of the student's achievement in that area (Grant and Bennett, 1968).

Non-Cognitive Selection Factors

While the use of non-cognitive selection factors has not been institutionalized in the medical school admissions process to the degree that use of cognitive factors has, nevertheless, a fair amount of research has been conducted over the last twenty years in examining the predictive validity and utility of such factors. Research on biographic/demographic variables has centered on discovering which variables have utility for predicting medical school performance and, more recently, which can predict such career decisions as specialty choice and practice location. Research on personality variables in the admissions process has concentrated on their role in determining medical school performance. In a detailed study of sample cases illustrating the different ways in which the cognitive indicators for a single applicant might be discrepant, Funkenstein (1965) demonstrates the utility of noncognitive information for resolving such discrepancies. Cleitham (1962) had also urged this particular use of non-cognitive data.

BIOGRAPHIC/DEMOGRAPHIC FACTORS

The major source of data in the admissions process on the background and demographic characteristics of applicants is the application form. The information which is derived from interviews and letters of recommendation on these types of characteristics supplements that requested

on the application form and usually explains extraordinary circumstances in the applicant's background which cannot be fully described in the space allotted on the application. The primary use of letters and interviews is in the assessment of personality characteristics and interests.

The survey conducted in connection with the AAMC's Fourth Teaching Institute summarized the percentages of medical schools which requested each of various pieces of information on the application form (Ceithaml, 1957). That summary is reproduced in Table 4.2, with those pieces of information also requested on the present AMCAS form indicated with a star or dash. As mentioned earlier, 74% of the U.S. medical schools participated in AMCAS for the academic year 1976-77 (AAMC, 1976c) and can, thus, be considered to have requested the indicated bits of information. Some of these AMCAS schools also require applicants to complete a supplementary application form which is unique to the school. Some of the non-AMCAS schools use a form very similar to that of AMCAS while others use forms that are quite distinctive.

The information requested on application forms is of two types: (1) biographic, describing a history unique to the individual applicant; and (2) demographic, classifying individuals in terms of attributes possessed by all members of the applicant population. Much of the biographic information is used to assess characteristics of the individual which really fall into other domains, especially into the personality domain. Thus, some types of "extra-curricular activities" might be considered a reflection of both interests and leadership ability. However, a major problem with this use of biographic information is that it is based on scanty evidence relative to (a) which personality concepts are being tapped by which biographic data and (b) the degree to which biographic data can accurately assess such concepts. For example, does "academic honors received" reflect intellectual ability or academic interests or capacity for work and perseverance? Probably, all three, but how much of each is reflected in the single biographic item? Even more importantly, are any of these concepts predictive of medical school or physician performance?

In fact, this confusion of the characteristic being assessed with the procedure by which it is being assessed is particularly acute in the entire non-cognitive domain. See, for example, in Tables 4.3 and 4.4 the multiple uses to which the application essay and the admission interview were put by participants in the Fourth Teaching Institute (Gee and Cowles, 1957).

Because the majority of biographic items are primarily aimed at concepts which are herein classified as personality characteristics, they shall be dealt with in that section.

Table 4.2

INFORMATION REQUESTED ON APPLICATION FORMS BY MEDICAL SCHOOLS*

Information on forms	% of 90 schools
Specific Items	
*Date of birth	100
*Schools previously attended	99
*Name of parent or guardian	98
*Dates of attendance at previous schools	97
*Home address	97
*Present address	93
*Previous degrees earned	93
Photograph	89
*Place of birth	87
-Have you taken the MCAT?	83
*Were you ever previously enrolled in medical school?	81
*Address of parent or guardian	80
*Occupation of parent or guardian	79
*Date on which MCAT was taken	79
*Military service	79
Plans for financing medical education	78
-In which medical school were you previously enrolled?	76
-List physical handicaps	68
*Dates of previous attendance in medical school	66
-Occupation since last attendance in school	62
Have you applied to this medical school before?	60
*Draft status or classification	52
Place where MCAT was taken	52
*Branch of military service	49
-U.S. citizenship	44
*Extracurricular activities	43
*Dates of military service	40
*Any previous dismissals from school?	38
*Academic honors received	38
*Public law entitlements if veteran	36
*Telephone number	32
*Age	31
Number of children	31
*Summary of undergraduate courses	29
*Previous attendance at professional (nonmedical) schools, and names	29
*Number of dependents	28
*Dates of previous attendance at professional (nonmedical) schools	27
-Necessity of part-time work	27
*Reasons for dismissals from school	26
-Courses in organic chemistry previously taken	24
Church affiliation or religion	21
*Name of college or university now attending	21
-Eligibility for readmission to any medical school enrolled in previously	20
-Nationality	17
Marital status	17
Length of residence in state of school to which application is made	17
Names of relatives who have attended school to which application is made	14
*Field of concentration at previous schools	12
Date dismissed if previously dismissed from school	12
To which other medical schools have you applied?	12
Name and/or address of premedical advisers	12
-Name of school dismissed from, if ever dismissed	11
*Length of military service	11
*Any discontinuation of study because of physical handicap	11
If not a citizen, steps taken to become one	9
Request for essay	
*Essay required	54
Essay to be handwritten	38
State reasons for studying medicine	37
Include statement of extracurricular activities	19
Essay has a word limit.	18
State reasons for applying to this medical school	14
Include any academic honors	8
Request for references	
State names of character references	30
State names of academic references	27
State names of professional references	18
Blanks for academic references included	28
Blanks for character references included	3
Blanks for professional references included	1
Request for health data	
Health report forms included	24

Source: Ceitham], 1957, p. 50

* Starred items are requested on AMCAS application in same general format. Items indicated by a dash overlap with those on the AMCAS form, but are requested in a different format, e.g. in combination with 1 or more other items. See next page for information requested on AMCAS application but not listed above.

TABLE 4.2a

Information Requested on AMCAS Application
But Not Listed in Table 4.2

Social security number
Legal address
Non-Citizenship: type of visa
Sex
Education of parents or guardian
Age of dependents
How do you describe yourself (racial/ethnic identity)?
Do you wish to be considered as a minority group applicant?
Age of your brothers
Age of your sisters
Dates at graduate or professional schools attended
Degrees expected
Candidacy for graduate degree
Highest rank attained in military
Type of military discharge
Military reserve status
Selective service status
Summer jobs during college: type of work and year
Exployment during school year: type of work and hours per week
AMCAS supplementary totals of course hours
GPA's and credit hours - AMCAS conversion
MCAT scores
Plans to take or retake MCAT after submitting AMCAS application

TABLE 4.3

COMMITTEE ESTIMATES OF VALUE OF ESSAY AND/OR AUTOBIOGRAPHY IN APPRAISING APPLICANTS

(Committee members group)

Appraisal from essay and/or autobiography	% of 371 members citing value of essay and/or autobiography*				
	None	Little	Some	Much	No response
Indication of applicant's proficiency in English composition and grammar	1	5	41	45	8
Indication of sincerity of applicant	4	33	36	19	8
Check on motivation of applicant	5	42	35	10	8
Appraisal of applicant's handwriting	16	29	33	14	8
To help in the detection of abnormal personalities	6	23	46	16	9
To yield information for use in subsequent interviews with applicant	10	18	43	19	10
Other	1	0	1	3	95

*Of the 534 committee members, this 69 per cent said they used the essay and/or autobiography in appraising applicants.

Source: Gee and Cowles, 1957, p. 202

TABLE 4.4

OPINION ON POTENTIAL ADVANTAGE OF INTERVIEW TO SCHOOL IN RELATION TO EXTENT OF USE OF INTERVIEW (Participants group)

Potential advantage of interview	Evaluation by % of 65 schools using interview much					Evaluation by % of 26 schools using interview some, little, or not at all				
	No value	Little value	Some value	Much value	No response	No value	Little value	Some value	Much value	No response
It allows the admissions committee an opportunity to verify and clarify information obtained about the applicant	0	0	23	77	0	0	4	58	34	4
It permits the committee to ascertain whether the candidate possesses any obvious physical or mental handicaps (speech impediment, tics, etc.)	0	0	17	83	0	0	4	23	69	4
It affords the interviewer an opportunity to delve into an applicant's motivation for the study of medicine	0	9	45	46	0	4	38	31	23	4
It gives the interviewer an opportunity to give the applicant detailed information about the medical school	3	23	54	20	0	11	27	27	31	4
It allows a first-hand evaluation of the applicant's intellectual abilities	0	18	60	22	0	8	34	50	4	4
It permits an evaluation of the applicant's cultural breadth	0	11	55	34	0	0	19	62	15	4
It affords an opportunity to assess the applicant's ability to withstand stress	8	37	37	17	1	8	30	54	4	4
It permits observation of the applicant (poise, frankness, bearing, etc.)	0	0	23	77	0	0	0	54	42	4
It permits an assessment of the skill of the applicant in interpersonal relationships	0	9	57	34	0	12	11	69	4	4
Other	0	0	3	2	95	0	0	0	8	92

Source: Gee and Cowles, 1957, p. 205.

Demographic variables, on the other hand, can be interpreted much more straightforwardly, since there is no filter of measurement procedure or conceptual operationalization to obscure the picture of their relationship to either medical school or physician performance. In fact, Sanchez (1975), in calling for an increase in the number of minorities admitted to medical school, considers that minority status is a less arbitrary criterion than many others now used in the admissions process. He contends that admissions policies have been vague and in recent years, "social needs and pressures have led to demands for more precise formulations."

Demographic Variables and Medical School Performance

In their comprehensive study of attrition, Johnson and Hutchins (1966) examined 14 demographic characteristics of students. Only 6 showed a statistically significant relationship to attrition/progress. Students making "irregular progress" were categorized into four groups: repeaters, academic dropouts, nonacademic dropouts and the total of the three preceeding categories. It was found that non-academic dropouts and the total irregular progress group had more siblings than students with regular progress. Fewer students in all four of the groups with irregular progress were married, however, academic dropouts had more children than regularly progressing students. A smaller percentage of the fathers or other relatives of nonacademic dropouts were physicians and the educational level of the mothers of students in the total irregular progress group was somewhat lower.

There were no significant differences obtained in the median ages at which dropouts, repeaters and students with regular progress entered medical school, but a strong negative relationship was shown between age at entrance and percent of dropouts. The relationship was greater for academic than for nonacademic attrition. It was also shown that women had higher dropout rates than did men, but the discrepancy was wider with respect to non-academic than to academic attrition. Since this particular finding was derived from data on 1949-58 entrants, it seems likely that, with today's more supportive environment for women medical students, sex may become an invalid predictor of medical school performance in the future (Johnson and Sedlacek, 1975).

The findings on marital status, namely, its enhancement of medical school performance, are supported by the work of others (Lefevre and Goolishian, 1964; Motto and Werner, 1965b), though, in their review Gottheil and Michael (1957) concluded it was an unimportant predictor.

They came to a similar conclusion regarding the importance of age at entrance to medical school as a predictor of medical school performance. However, in another study, age was shown to distinguish

students ranked high at the end of the first year from those ranked low, such that the older students tended to rank lower (Lief, Lief and Young, 1965).

Kelly (1957b) found age to be negatively related to the statistically-derived factors of achievement in the first two years of overall achievement. Haley et al. (1971), in examining the characteristics of those students with low, middle and high MCAT factor scores, found that the percentage distribution of those who entered medical school at less than 21 years of age was such that there were more high and fewer low scorers than those entering at the ages of 21-24. Half of this latter group were middle scorers, one-fourth were low scorers and one-fourth were high scorers. Of those who were 25 years of age or older at entrance to medical school, their scores on the MCAT factor were almost evenly divided among the low, middle and high categories.

Demographic Variables And Physician Performance

The Utah studies of physician performance (Price et al., 1971) examined the prediction of career performance from biographical and medical school information in Project B of their Predictor Study II. What they called "biographical" predictors are essentially indices of medical school performance, one of which can be considered a proxy demographic variable. No outright demographic variables were used. The proxy, age at medical school graduation, not entrance, was examined in relationship to the various performance criteria. While age at graduation is not perfectly correlated with age at entrance, due to the different rates at which students progress through medical school, it can, nevertheless, be used as a fairly close approximation. Thus, students who are older than average at entrance will generally be older than average at graduation.

The results of the Predictor Study-Project B correlations, which are based on a sample of 507, showed above-average age (more than one standard deviation above the mean) to be negatively related to two indices of medical school GPA (at the .05 level of significance for first-two years GPA). Average age, however, was positively related to GPA during the first two years ($p < .05$). Above-average age was also negatively related to ratings of physician performance ($p < .05$), while under-average age was positively correlated ($p < .05$) with this criterion. Age was also shown to be significantly related to the type of practice in which the physician was engaged. Those older than average were more often in general practice, while those younger than average were more often in specialty practice. It should be noted here that in response to societal needs for diversified physician manpower, type of practice and specialty area are increasingly being considered part of the criterion of physician performance.

In another study which directly examined the relationship between academic performance and career preferences (Lief et al., 1965), it was found that lower ranking students tended to choose general practice more often. They also were more likely to marry earlier and come from a small town.

This particular configuration of characteristics -- small town origin, preference for general practice and lower cognitive characteristics -- was replicated by Haley and Paiva (1969). They also report high religious and social orientation to be part of the pattern.

Cullison et al. (1976a) likewise found that the size of the city or town from which a student originates is related to the specialty which he/she chooses and to the location in which he/she practices.

Colwill (1976) carried the association between hometown size and practice location further by demonstrating that it is the combination of a rural background and a preference for family practice which is most likely to result in a physician's practicing in a rural area. Thus, while rural or small-town origins are more likely to be accompanied by a preference for family practice than are more urban origins (as shown by Haley and Paiva, and Cullison et al.), in those cases where family practice is not preferred, the probability is much lower that the physician from a rural background will practice in a rural area.

In a survey reported by Schroeder et al. (1974) the career intentions of applicants affected the decision to admit or reject in 39% of the academic medical centers. Forty-eight percent of these centers indicated they formally reviewed the career choice of their students at graduation, 15% five years after graduation and 12% ten years after graduation.

In a report on the specialty and location choice of physicians conducted for the Robert Wood Johnson Foundation, Yett (1976) and his associates at the Human Resources Research Organization concluded that the literature on predictors of these physician career choices is fragmentary. They felt that there is a need to clarify further the characteristics which are associated with location of medical practice in an underserved area.

Mattson et al. (1973) report on results of a joint program established in 1948 by the Illinois Agricultural Association and the Illinois State Medical Society in conjunction with the University of Illinois Medical School. The program is based on the preferential admission and/or financial assistance of state residents with below normal academic credentials who commit themselves at the time of application to five years of the practice of family medicine in a rural area. The effectiveness of the program is documented by the fact that, though the specialty-admitted students had a higher attrition rate,

a much greater percentage of those who did graduate eventually located in the state, eventually located in a rural area of the state, and were in general practice than was true of the regularly-admitted students. In fact, for the state of Illinois, "the program produced almost all of the rural physicians during the period covered" (p. 328).

While an outright committment to practice in an underserved area is not very often used as an admission criterion, as in the Illinois program, the demographic factor of legal residence in the same state as the medical school to which the student is applying is a criterion now used by practically all publicly supported medical schools. In the majority of cases, this criterion is emphasized in the school's entry in the Medical School Admissions Requirements handbook.

Perlstadt (1975) contends that state residency, MCAT-Science score and tuition are the three factors which really control the admission gateway. That this admission criterion, state residence, is not completely predictive of a medical school entrant's first practice location, let alone ultimate practice location, is attested to by the various studies on the factors influencing physicians' mobility.

PERSONALITY TRAITS AND INTERESTS

The primary focus of that part of the admissions process concerned with personality traits has been an attempt to capture what are, compared to cognitive and biographic/demographic characteristics, rather amorphous qualities. These attempts have been directed towards identifying those particular personality traits which influence medical school performance and towards determining the extent of their influence. Lately this concern has widened somewhat to include some study of their relationship to medical specialty and other career preferences.

The issue of career preferences is part of the broader issue of interest in and motivation for a medical career. Because the same general sources of information are used to assess interests and personality traits and because personality traits and interests are themselves interrelated, these two types of admissions factors shall be considered together in the present section.

There are three basic sources of data on an applicant's personality and interests: the interview, structured personality tests and the application materials, including an essay by the applicant and letters of recommendation. Table 4.5 shows the extent to which participants at AAMC's Fourth Teaching Institute used various sources of information to evaluate noncognitive characteristics of applicants (Ceithaml, 1957). It is clear that the interview and written evaluations (or letters of recommendation) are heavily relied upon to provide noncognitive

TABLE 4.5

PRESENT USE OF VARIOUS SOURCES OF INFORMATION IN EVALUATING NONINTELLECTUAL CHARACTERISTICS
(Participants group)

Source of information	% of 91 participants citing extent of use					
	None	Little	Some	Much	Not Obtained	No Response
The personal interview	0	3	23	72	1	1
The psychiatric interview	7	27	21	4	40	1
Objective personality test results	13	16	2	4	62	3
Projective personality test results	17	11	1	2	66	3
Vocational interest test results	17	15	7	1	59	1
Ability and achievement test results	9	9	26	29	25	2
Premedical committee or premedical adviser evaluations	0	2	29	68	0	1
Written evaluation by premedical instructor(s)	1	8	39	50	1	1
Other written evaluation	5	23	18	7	3	44
Health report from student	7	22	37	16	17	1
Health report from physician	4	8	25	40	22	1
Extracurricular activities	2	17	56	22	2	1
Chronological continuity of education through high school and college	11	25	41	21	1	1
Work experience	9	27	53	8	2	1
Information concerning financial need	10	25	49	12	3	1
Photograph	14	42	28	13	2	1
Autobiographical sketch	2	16	25	14	42	1
Essay on selected topic (other than autobiography)	6	4	16	3	69	2
Other data from application blank	3	6	25	10	1	55
Other nonintellectual appraisal from source not mentioned above		6	4	6	1	79

Source: Ceithaml, 1957, p. 53.

information on the applicant, which will hopefully forecast his future performance. Let us consider first the interview, since it has engendered much more discussion and investigation than have letters of recommendation.

The Interview

In a penetrating study of its own policies and procedures, the Harvard Medical School Admissions Review Committee recently concluded that there were two especially controversial issues concerning admissions procedures (Report..., 1975). One of the two issues was the role of the interview in admissions. Proponents of the interview felt that it yields data which better distinguish among applicants than do the data from letters of recommendation, the MCAT and GPA's. Since the latter are almost universally excellent, most Harvard applicants appear to be very similar. Opponents of the interview contended that there is no actual proof of its value and that, furthermore, the data obtained are different from one interview to the next. Besides recommending guidelines as to which applicants should be interviewed and by whom, the Report called for revisions in the use of the interview. Specifically, the committee recommended that there be a greater degree of structure to the interview in order that the same type of data be collected on all interviewees. It also recommended that the process of interviewing be separated from that of selection, so that the interviewers not be personally involved in the final step of selection which is taken by the admissions committee.

The two opposing views of the value of the interview seem to have changed little over the last two decades. In a critique of the interview made to the Fourth Teaching Institute, Kelly (1957a) reported that "all evidence suggests that it gives a great deal of satisfaction to the persons who use it; they usually feel good about it, but we have not been able to demonstrate in any of these investigations the utility of the interview. And, in view of its cost in terms of professional time, our findings raise serious doubt whether it can be defended as an economical procedure" (p. 78).

Both Kelly and Glaser (1958) predicted that, in spite of its drawbacks and the evidence which negates its predictive validity, the interview would continue to be an important part of the admissions process until more valid techniques were devised for selection. Apparently such techniques remain to be devised, since a recent survey of admission policies and procedures (Char et al., 1975) found that there was an almost universal reliance by the medical schools responding to the survey on three parameters for selection -- GPA, MCAT and the interview. Furthermore, the survey found a general feeling of dissatisfaction with all admissions processes, but especially with those in the area of assessing personality traits and selecting for clinical

competence. Divergent views on the utility of the interview were again in evidence.

A few studies have addressed themselves to specific problems with the interview. Handler (1957) pointed out that information derived from the interview can be misleading if taken at face value. As an example he cited his finding that: "Most women are quite sensitive to the fact that they are being discriminated against, and most of them are quite sensitive to the fact that it is very hard to combine motherhood and a career in medicine. I have seen quite feminine women in medical school who have hidden their femininity; some have denied it to themselves because they felt that it was just not right" (p. 72).

Becker (1956) demonstrated that misleading interview information can also result from the interviewer's manner as well as from the interviewee's representation of him/herself, which Handler had pointed out. Becker found that, when the interviewer displayed a pragmatic, realistic orientation to medicine as a career, students were inhibited from expressing "idealistic" motives. Conversely, when the interviewer was "idealistic," students refrained from any expressions of cynicism.

A proposed way of dealing with "faking" and with the variation in interviewing skills of the interviewers is the group interview (Jackson and Kellow, 1958). In an experiment to assess the value of this technique, 129 applicants to the University of Illinois over a period of three years were interviewed in groups of six. Two assessors rated them on each of four categories of acceptability on the basis of attributes discerned from the individual's participation in the group discussion. It was felt that the group interview tested the candidate's ability to use knowledge in a social situation and provided greater discrimination among qualified applicants.

In a diametrically-opposed approach, i.e. increasing the number of interviewers, rather than the number of interviewees, at a single interview session (Char et al., 1975), it was felt that the team approach had the advantages of (1) yielding more interesting and stimulating interviews, (2) helping interviewers to be more objective and comfortable in their evaluations, (3) identifying the biases of each interviewer and correcting for applicant-interviewer mismatch and (4) revealing more of an applicant's personality through his interactions with several interviewers. This procedure, used at the University of Hawaii, involved a three-person team of psychiatrist, psychiatric social worker and second-year medical student who rotated as principal interviewer and as the person responsible for writing up the interview. Each interviewer rated the candidates on "emotional stability, basic intelligence and organization of thought, capacity for empathy and warmth, interpersonal relationships, psychosocial adjustment, self-identity, ethics and morality. The team members then

met to discuss their individual evaluations and to write a composite report on the applicant for the Admission Committee" (p. 193).

Does the information collected in the interview, regardless of its validity, predict performance in medical school? In their study of the intellectual and personality predictors of first year academic success at Tulane University School of Medicine, Lief et al. (1965) summarized their findings regarding the interview as follows:

> Our data tended to confirm the now generally accepted opinion that admissions interviews were of no particular help in predicting academic achievement. The quantitative ratings made by the interviewers at the time these students were candidates for admission showed no significant difference between the upper and lower ten groups (p. 116).

In another study which examined the ability of the interview to predict academic achievement (Richards and Taylor, 1961), those applicants to the University of Utah who fell into the middle group of neither outstandingly superior nor obviously unqualified were interviewed by two to four members of the admissions committee, each of whom rated the applicant on personal characteristics, chances of success and recommended decision. The three ratings were averaged over interviewers and were found to be highly intercorrelated. One possible interpretation of the high intercorrelation might be that it reflects the inability of interviewers to assess distinct characteristics independently and instead to produce an overall global assessment of the applicant. When the interview ratings were correlated with first, second and third year GPA, the highest coefficient was +.32 and the remaining coefficients much lower.

Burgess et al. (1972) found that both the physician and non-physician interviewers whom they were comparing gave overall global impressions rather than an assessment of individual personal characteristics, even though they were required to rate each of several applicant attributes on a six-point rating scale. The authors also found that, in spite of training sessions to increase interviewer reliability, the agreement between interviewers was only 28% on applicant's perception of medicine and 31% on personal appearance. However, agreement was more than twice as high (73%) on recommended admissions decision.

In regression analyses of the predictors of yearly grade point averages at Tulane, Hoffman et al. (1963) found that the Personal Interview Rating, "a composite rating based on three pre-admission interviews performed by three members of the medical school faculty"

(p. 853) was the most consistent predictor in comparison to the predictors of age, MCAT scores and of science and overall GPA. Although the science predictors were better predictors of performance in the first two years, their predictability vanished for the last two years, while that of the interview remained stable, though not especially high. Blumgart (1964) also notes the limitations of the interview for obtaining information on factors related to medical students' academic performance.

Attempts to structure the interview and increase the reliability of the information collected have focused on either specifying the topics to be discussed with the interviewer or specifying the traits or attributes of the interviewee which are to be rated. Motto and Werner (1965a) reported on their "continuing effort to identify variables that are significant to medical student performance patterns beyond the second year and are elicitable in an admissions interview" (p. 899). They used "an interview outline of 233 questions about personal background. Areas of inquiry include: study and learning characteristics; prior exposure to various aspects of medicine and disease; perceptions of the family patterns of interaction; and perceptions of parent, sibling, faculty and peer characteristics." In a report on partial results of this approach (Motto, 1965), eight items having to do with perceptions of parents were able to discriminate among students categorized by their performance in medical school.

In an exploratory study, Price et al. (1971) analyzed tape-recorded interviews for the consistency with which interviewers asked questions related to the same area. After sorting each question into seven broad categories, the results presented in Table 4.6 were obtained. The taped interviews were also analyzed for four major time scores: "(1) length of pauses, (2) time spent asking questions, (3) time spent giving answers, and (4) time spent giving additional information statements" (p. 27). As would be expected, the self-consistency of each interviewer across his interviews was high, while the consistency across interviewers was not.

Reed (1975), however, investigated the reliability and validity of 38 physician interviewers who interviewed 1,248 applicants to the University of Missouri-Columbia over a two-year period and concluded that most of these interviewers were both reliable and correct in their ratings.

Gellmann and Steward (1975) found, by means of an anonymous survey, that applicants rated the interviewing skills of medical students equal to those of faculty members on all of the categories considered. Applicants reported a high level of satisfaction with the student interviewers.

TABLE 4.6

Percent of Questions in Each Category Asked by Each Interviewer

Question Category	Interviewer						
	I	II	III	IV	V	VI	VII
Biographical Information	50.7	50.6	25.9	43.6	44.9	38.7	48.3
Motivation-Interest	31.3	8.7	33.3	12.3	21.4	6.6	34.1
Self-Insight	6.0	24.5	40.8	10.6	3.1	11.3	
Analysis-of-Others	1.5	3.9					
Reasoning and Speed of Learning				18.7	1.0		7.7
Technical Subjects				11.6	19.4	37.7	9.9
Introduction and Termination	10.5	12.3		3.2	10.2	5.7	

Source: Price et al, 1971.

That applicants feel generally positive about the value of the interview can be inferred from the results of a survey by Poorman (1975a) of the applicants to the Class of 1975 at the University of Kansas. Ninety-nine percent (99%) felt that the interview had a proper place in the admissions process; 82% felt the interviewers knew them better after the interview; 62% felt that the interview enhanced their chances of being admitted (32% felt it had no effect and 6% felt it decreased their chances). Furthermore, 77% felt that the questions they were asked were relevant to whether they would make a good physician, 63% felt the questions were pertinent to prediction of their success in medical school and 78% felt an attempt had been made to ascertain their motivation for a medical career. The existence of favorable attitudes toward the admissions interview and toward a psychiatric interview as part of the admissions process was also shown by Gee (1957).

Particularly noteworthy among the attempts to structure and increase the reliability of the interview is the Simulated Minority Admissions Exercise (SMAE) (D'Costa, Bashook, Elliott, Jarecky, Leavell, Prieto and Sedlacek, 1974). Developed under the auspices of the AAMC, the major purpose of the SMAE is "to broaden the perspective of admissions committee members so that their interviewing follows a plan which enables them to perceive qualities of the applicant that may identify him or her as the sort of person sought by the school" (Jarecky, 1974, p. 13). While simulation exercises with particular emphasis on minority student selection are necessary for most medical school admission committees because the members of these committees may tend to perceive all applicants through the prism of the White middle class value structure" (ibid.), their value will carry over to the admission of all applicants. "To the degree that simulation assists admissions committees to clarify admission objectives and to understand what data should be derived from the interview process and how that data should then be treated, the procedure should prove to be a useful tool indeed" (ibid., p. 15).

The SMAE is predicated on the view that, for minority applicants especially, many sources of data on their qualifications for medical school yield misleading and invalid information. The MCAT is considered culturally biased. GPA is misleading because some minority group members, due to lack of reinforcement for academic accomplishments by the society at large, do not strive for achievement in this area. Even the information derived from the application form may be misleading:

> In many respects, the application forms for medical school and the information transmitted therein as well as the assessment of biographical data and of letters of recommendation (all normal sources of noncognitive data) are established within the framework of the traditional applicant.

> As such, they often are of limited value in the assessment of minority applicants. Further for students from other cultural backgrounds, the noncognitive variables themselves may take on an entirely different form. For an inner/city Black, demonstrated leadership may have been as a member of a street gang, and for a Chicano from New Mexico, in church activities. These may never get included in a medical school application which asks for a list of college related activities, expecting such responses as fraternity president, homecoming chairman, and debating team member (Elliott, 1974, p. 20).

Because of the importance of the interview in the SMAE framework, it is advocated that the interview and other noncognitive criteria come first in the admissions process, with the consideration of cognitive criteria coming last.

What, then, are the types of information which should be sought in the interview according to the SMAE? "The Simulated Minority Admissions Exercise does not advocate lower standards or second class status for minority students. Rather it advocates the use of the most appropriate, albeit nontraditional, information in selecting such applicants" (Sedlacek, 1974, p. 32). The nontraditional variables proposed by the SMAE were derived from Sedlacek's work at the University of Maryland's Cultural Study Center and from the practical experiences of the SMAE author team. They are: "positive self concept, understanding and handling of racism, realistic self appraisal, preference for long range goals over immediate needs, availability of strong support person, successful leadership experience, demonstrated community service, and demonstrated medical interests" (ibid.).

Simulation exercises are designed to sensitize admissions interviewers to asking questions which would shed light on these areas. The specially constructed cases are based on 10 actual nontraditional applicants and their application materials and interview responses concerning family relationships; academic progress; honors, interests, experiences; community service, leadership, racial perceptions; professional goals and career development; and medical education readiness. It is felt that the applicant's answers to questions on these topics will provide data for the non-traditional criteria.

An evaluation of the SMAE (Bashook and Leavell, 1974) was conducted regarding the participants' increased sensitivity to non-cognitive variables. The data presented in Tables 4.7 and 4.8 show that (1) participants still relied quite heavily on the traditional criteria of GPA, MCAT scores and faculty letters of recommendation, though they did

TABLE 4.7

Ranking of Variables Used by SMAE Participants in Admission Decision

Variables	All Applicants		Applicant Cases									
	Overall Rank	Mean Rank	MF 1	JH 2	LJ 3	GS 4	GM 5	AP 6	BM 7	RM 8	FW 9	JW 10
			Ranking Within Case									
Positive self-concept	2	2.4	2	3	2	2	1	2	4	5	2	1
Handling of racism	6	7.8	8	5	14	3	14	7	5	8	6	8
Realistic self-appraisal	5	7.3	14	6	3	8	7	3	8	14	3	7
Preference for long range goals	7	8.1	1	7	10	9	9	6	6	7	12	14
Availability of strong support person	13	10.0	13	14	5	14	13	5	14	4	14	4
Successful leadership experience	11	9.8	11	10	8	13	10	9	12	6	7	12
Demonstrated community service	14	10.9	5	4	13	10	11	14	13	13	13	13
Demonstrated medical interest	8	8.4	8	11	9	6	8	10	10	3	8	11
Premedical faculty rating	4	5.1	6	5	4	7	3	8	2	2	5	9
Grade point average	1	1.4	3	1	1	1	2	1	1	1	1	2
Medical College Admission Test scores	3	4.4	4	2	7	4	4	4	3	9	4	3
New Variables												
Extracurricular activities	9.5	8.8	8	4	11	11	5	11	9	10	9	10
Family ties and finance	9.5	8.8	11	8	6	5	12	12	7	11	11	5
Interviewer's assessment	12	9.9	7	9	12	13	6	13	11	12	10	6

Source: Bashook and Leavell, 1974, p. 76.

TABLE 4.8

Agreement of SMAE Participants' Ratings and Assigned Ratings of Variables for Applicant Cases

Variables	Percent Acceptable* (N=130)
1. Positive self concept	66.7
2. Handling of racism	52.3
3. Realistic self appraisal	41.9
4. Preference for long range goals	55.0
5. Availability of strong support person	67.7
6. Successful leadership experience	66.2
7. Demonstrated community service	61.2
8. Demonstrated medical interests	66.9
Average for Eight Noncognitive Variables	(59.7)
9. Premedical faculty rating	60.3
10. Grade point average	79.4
11. Medical College Admission Test scores	72.1
Average for Three Cognitive Variables	(70.6)
Average for 11 Variables	62.6

*An acceptable rating means that participant rating coincided with the authors' assigned rating of the 10 cases on the 11 variables. See Table 1.

Source: Bashook and Leavell, 1974, p. 77.

show increased sensitivity to some of the noncognitive predictors, and (2) that participants generally rated the applicants (high, medium or low) on each variable as had the SMAE authors.

> Obviously, there exists an inferential jump between what a participant says on paper or to workshop staff and what he/she does later as a member of an admissions committee. At the present time, the only evidence bridging this gap in information lies in the unsolicited follow up requests by participants to have their school's entire admissions committee attend a future Simulated Minority Admissions Exercise Workshop. After the initial Association of American Medical Colleges-supported series of regional workshops, each workshop a medical school requests costs the school both money and faculty time. Not counting the regional workshops, 20 medical schools of the 108 represented at regional sessions have requested individual programs for their admission committees. Other special groups also have asked to participate, namely, the Mid-West Great Plains Deans, premedical advisors, the Osteopathic Medical School Association, and the Veterinary Medical School Association. It should be kept in mind that requesting participation does not mean changing the admissions procedure at the school, but rather, a willingness to explore a new approach to minority admissions. These requests for workshops may indicate an initial shift in attitudes and also a move toward a rational affirmative action program. Indeed, such action can have positive implications for the entire admissions program. As one letter from a participant stated, the workshop "has been instrumental in admissions changes or different approaches in several of the western schools, not only for minority but for all admissions" (ibid., pp. 74-75).

Finally, another approach to the training of admissions interviewers is reported by Litton-Hawes, MacLean and Hines (1976). Five committee members (at Ohio State) interviewing in pairs were videotaped during 3 admissions interviews and their verbal and nonverbal behavior evaluated. Two common problems were identified: inefficient use of time and reliance on the applicant's written file. Inefficient use of time was a consequence of asking detailed questions early in the interview and thus inhibiting responses to broader, more general questions asked later on. Reliance on the written file resulted in (1) specific questions

early in the interview, (2) decreased eye contact which made it more difficult to establish rapport and to observe nonverbal cues of the applicant and (3) concentration on quantitative criteria early in the interview which biased the interviewer so that he/she filtered subsequent information to hear only information confirming his/her judgement.

"The authors summarized recommendations to the admissions committee in the form of an instructional video tape. Excerpts of the original recordings were used in the tape to illustrate specific problems and demonstrate some of the more effective interviewing strategies. The tape has been requested and used by many universities throughout the United States and several foreign countries for the training of admissions interviewers" (p. 4).

It is obvious from the research on the interview which has been cited that there has been a good deal of effort devoted to improving its utility. Poorman (1975a) pointed out that 104 of the 109 schools providing data for the 1975-76 edition of MSAR interviewed all of their entrants, so it is valued as a selection criteria. Nevertheless, he concluded that "The validity of the interview remains obscure. However, as long as admissions committees and applicants believe that the interview has a proper place in the medical school admissions process, the practice will be continued" (p. 301).

Application Materials

The three types of application materials -- recommendations, applicant essays and biographic (as opposed to demographic) information — share with the interview the characteristic of yielding highly variable types of specific information from one applicant to the next. The characteristic which they do not share with the interview is that of having engendered a great deal of research devoted to their development and refinement. While all are and have been an integral part of the admissions process over the years, there has not been much effort expended on enhancing their utility for collecting that noncognitive information which has validity for predicting either medical school or physician performance. While the reason for this lack of research probably has roots in the lack of any conclusiveness regarding which noncognitive facptrs are most related to performance, this would also be true of the interview. Furthermore, as was indicated in Table 4.5, the use by the Fourth Teaching Institute participants of written evaluations, at least, equaled that of the interview. Lack of research interest in applicant essays and biographic information is understandable as a reflection of the lesser use of these items evidenced in the same Institute data.

The landmark Fourth Teaching Institute (Gee and Cowles, 1957) is the most comprehensive source of information on the use of application

materials. Table 4.9 reproduces data from that report which show that recommendations from premedical advisors were considered especially valuable for assessing scholastic achievement, even though this might be equally well assessed through the GPA. It was considered almost as valuable for the assessment of scholastic potential, another assessment available through other sources, namely the MCAT. Thus, advisor's recommendations are particularly useful when the GPA or MCAT do not give an accurate picture of an applicant's true potential.

The findings of Richards and Taylor (1961) are pertinent here. The premedical advisor ratings of 322 students admitted to the medical school at the University of Utah from 1951 to 1957 were correlated with their undergraduate GPA's and a coefficient of +.45 was obtained. The correlation coefficients between premedical advisor ratings and medical school GPA's were: +.25 for first year, +.31 for the second year and +.03 for the third year. The results suggest that advisor ratings are reflective of an applicant's undergraduate achievement, but not very predictive of his/her medical school achievement.

According to Table 4.9 the unique value of premedical advisors' reports for the Institute participants seems to have been in their assessment of those indefinable traits, "character," "integrity" and "leadership qualities." Particularly noteworthy is their lack of value for assessing "motivation for the study of medicine" and "suitability as a potential physician."

What may be a more productive approach to recommendations is to have them written by the applicant's fellow students. At first glance, such recommendations seem open to charges of various sorts of bias, but Leape, Palubinskas, Steindler, Wild and Dalrymple (1976) recently showed these charges to be invalid, at least for their sample.

> One hundred thirty-seven applicants to Tufts University School of Medicine from Tufts University and Princeton University were requested to send the names of three fellow students who "you feel know you well." Peers were then asked to fill out a confidential evaluation form which was returned directly to the Admissions Committee.
>
> Peers were asked to select statements concerning the candidate's motives for studying medicine and to rank him on a five-point scale in comparison with other college students regarding 25 personality and character qualities. They were asked to give comments as to major strengths and weaknesses and to predict the candidate's future success as a physician.

TABLE 4.9

COMMITTEE ESTIMATES OF VALUE OF PREMEDICAL ADVISORY REPORTS IN APPRAISING APPLICANTS
(Committee members group)

Applicant characteristic	% of 534 members citing value of premedical report in appraising various characteristics					
	None	Little	Some	Much	Report not obtained	No response
Character	1	9	52	33	2	3
Integrity	1	9	51	34	2	3
Motivation for the study of medicine	5	37	43	10	2	3
Leadership qualities	1	13	48	31	3	4
Scholastic achievement	0	3	35	56	3	3
Suitability as a potential physician	7	36	43	9	2	3
Scholastic potential	0	9	51	33	3	4
Comparison of applicant with other applicants or with medical students from the same premedical college	2	8	36	46	5	3
Weakness and compensations, if any	2	13	48	26	4	7
Over-all rating (highly recommended, recommended with reservations, not recommended)	1	5	44	44	2	4
Other	0	0	1	1	*	98

*Less than 1 percent response.

Source: Gee and Cowles, 1957, p. 202.

TABLE 4.10

COMMITTEE ESTIMATES OF VALUE OF ESSAY AND/OR AUTOBIOGRAPHY IN APPRAISING APPLICANTS
(Committee members group)

Appraisal from essay and/or autobiography	% of 371 members citing value of essay and/or autobiography*				
	None	Little	Some	Much	No response
Indication of applicant's proficiency in English composition and grammar.	1	5	41	45	8
Indication of sincerity of applicant	4	33	36	19	8
Check on motivation of applicant	5	42	35	10	8
Appraisal of applicant's handwriting	16	29	33	14	8
To help in the detection of abnormal personalties	6	23	46	16	9
To yield information for use in subsequent interviews with applicant	10	18	43	19	10
Other	1	0	1	3	95

*Of the 534 committee members, this 69 per cent said they used the essay and/or autobiography in appraising applicants.

Source: Gee and Cowles, 1957, p. 202.

> Finally, peers indicated whether they too were premedical students applying to Tufts University School of Medicine (p. 586).

The ratings of his/her three peers were averaged for each applicant on four scales: people-related characteristics, maturity, drive/independence and predicted success. The scale scores were averaged into a single composite score and "essay questions were analyzed for superlatives, negatives, and extreme comments in the 'people-related' and 'maturity' and 'drive' categories" (p. 587).

The results showed several things. First, the method was well received, since 94% of peers completed the forms. Second, the evaluations were reliable, given that there was a wide range of scores on each scale, indicating that applicants were evaluated individually, and that the ratings of premed peers also applying to Tufts were not significantly different from non-applicant peers. Third, the results were useful in discriminating among applicants because of the wide range of scores. The approximately normal distribution of scores also attests to their validity, since one would expect that such characteristics would be normally distributed. Finally, the peer evaluation scores did not correlate with GPA or with faculty recommendations, demonstrating that they provide information on the applicant not duplicated by other sources.

Turning to the essay, Table 4.10 shows that, aside from their value as an "indication of applicant's proficiency in English composition and grammar," applicant essays were regarded only lukewarmly by Institute participants, having "little" to "some" utility for assessing the applicant's sincerity, motivation, handwriting and personality abnormalities.

In a study intended "to appraise objectively the usefulness of the autobiographical sketch in the medical student's application as a predictor of subsequent scholastic performance" (Holmes and Hertel, 1967, p. 269), predictions about a student's standing in the upper, middle or lower third after the first year were made on the basis of a reading of his/her application essay. When compared with actual standings, it was found that the predictions were considerably above the chance level ($p = .001$). The authors felt that the results suggested that the rater was relying on certain elements in the essay which were not conscious to him. While they recognized that further study might identify what these elements were, they considered the time and costs unwarranted given their expectation that the significant results would not be sustained for much time. This transciency would result from the essay's being an unstable predictor, "that is, one which applicants are capable of learning about, comprehending, and circumventing in ways in which such unmanipulative criteria as grade-point averages and MCAT scores are immune. This is not to be interpreted as meaning that the

autobiographical sketches should be abandoned as useless, but only to advise that they provide essentially a 'fluid' sort of information which has optimal significance only at a certain time and under certain rather immediate conditions" (ibid.).

Personality Tests

The third source of information on student characteristics in the noncognitive domain is that of structured personality tests. While the use of personality tests for the actual selection of students is not very extensive, the use of unstructured or projective personality tests for this purpose is even more limited. This was the case in 1956 (witness the data from the Fourth Teaching Institute presented in Tables 4.5, 4.11 and 4.12) and continues to be the case.

D'Costa and Schafer (1972) updated a survey by Schofield on non-cognitive tests used in medical schools but did not distinguish between the use of such tests for selection and the use of such tests for research on already-admitted students. That the latter use is much the greater becomes evident upon reading the literature on the personality assessment of medical students. Most researchers are practical people and, when suitable data are already available, will much prefer to take advantage of such treasure than to expend their efforts and funds in the collection of new data. Most of the research studies on personality tests indicate that the personality assessment instruments in question were administered after admission, usually to entering freshmen medical students.

The Rorschach is one of the best-known projective personality tests in general use. Table 4.13 shows that only a handful of Institute participants reported having used or were planning to use either the group or the individual administration versions of this test. It is not listed by any of the 117 medical schools responding to the D'Costa and Schafer survey (Table 4.14), though two other projective tests, the Bender-Gestalt and the Thematic Apperception Test, were each listed as used by 12 schools.

Among the major disadvantages of projective tests are the amount of time necessary to administer and score them, and the difficulty of interpreting the results. Therefore, their primary use in medical school admissions has been for the weeding out of applicants with personality traits outside the normal range; although Schofield (1957) points out that there is a second possible use, to identify "from among those who pass the initial screen the applicants who are positively endowed with characteristics significantly related to a high level of performance" (p. 117).

TABLE 4.11

STUDENT REPORTS ON USE OF PSYCHOLOGICAL TESTS OTHER THAN MCAT

(Medical freshmen group)

Response	% of 756 freshmen
Other tests taken	21
Other tests not taken	64
Don't know if other tests taken	15

Source: Gee and Cowles, 1957, p. 208.

TABLE 4.12

SOURCES OF INFORMATION ON MENTAL HEALTH OF APPLICANTS

(Participants group)

Source of information on mental health	% of 91 schools citing extent of use of source					
	Not obtained	None	Little	Some	Much	No response
Appropriate questions on application form	41	6	14	25	12	2
Personal interview	4	0	6	38	51	1
Psychiatric interview	38	1	23	20	14	4
Written essay by applicant	48	0	9	33	3	7
Physitian's report (non-psychiatric)	43	2	9	24	16	6
Psychological screening test	74	4	4	4	6	8
Other	1	0	0	4	6	89

Source: Gee and Cowles, 1957, p. 204.

TABLE 4.13

PSYCHOLOGICAL TESTS: PRESENT AND PLANNED USE IN EVALUATING NONINTELLECTUAL CHARACTERISTICS

(Participants group)

Name of test	% of 91 participants indicating use of test				
	Tried and dropped	Now in use	Planning to use	Not planning to use	No response
Strong Vocational Interest Blank	2	4	2	52	40
Minnesota Multiphasic Personality Inventory	4	7	2	51	36
Individual Rorschach	0	2	1	56	41
Group Rorschach	6	0	1	56	37
Kuder Preference Record	2	2	1	55	40
Cornell Medical Index	0	0	1	59	40
Other	1	2	5	2	90

Source: Caithami, 1957, p. 52.

TABLE 4.14

NUMBER OF SCHOOLS USING LISTED STANDARD INSTRUMENTS

	Number of Schools
Allport-Vernon-Lindzey Study of Values	18
Bender-Gestalt (Projective Personality Test)	12
California Psychological Inventory (Gough)	13
Cornell Medical Index-Health Questionnaire	13
Edwards Personal Preference Schedule	16
Group Rorschach Test	3
Guilford's Structure of Intellect Tests	1
Human Figure Drawing Techniques	12
Kuder Preference Record-Personal	8
Minnesota Multiphasic Personality Inventory	32
Myers-Briggs Type Indicator	9
Opinion, Attitude, and Interest Survey	7
Personality Research Form (Jackson)	4
Rokeach Open-Closed Minded	7
Sixteen Personality Factor Questionnaire	12
Strong Vocational Interest Blank	15
Thematic Apperception Test	12

Source: D'Costa and Schafer, 1972, p. 7.

Paterson (1956) indicated that a projective test useful in spotting psychopathological tendencies was being routinely given during the years 1950 to 1959 to those applicants to the State University of New York Downstate Medical Center who were considered sufficiently promising to be invited for a personal interview. More than ten years later the utility of the test (the Human Figure-Drawing Test) for the prediction of academic success or failure is examined and reported for the class of 1963 (Paterson, Moldowski and Moldowski, 1969). Drawings categorized as "minus" were "poorly organized, faintly sketched, and lacking in detailing and in a systematic approach to the task" (p. 930), while those categorized as "plus" were "drawings which showed better overall organization and appropriate detailing and gave an impression of a higher energy level (as shown, for example, in firm line pressure, adequate size and assertive stance)" (ibid.). Results showed that the test successfully distinguished dropouts and repeaters from students with regular progress ($p < .001$).

In order to show that students with "minus" drawings were not intellectually less able, the MCAT scores of students with "plus" and with "minus" drawings were compared. While statistically significant differences were obtained, their magnitude was relatively small and, in the case of the Verbal subtest, students in the "minus" group scored higher. The authors went on to show that the personality test was a better predictor of academic outcome than was the MCAT. Of the four subtests, significant differences between academically successful and unsuccessful students were obtained only on the Verbal and Quantitative subtests and, of these two subtests, unsuccessful students scored higher on the Verbal subtest than did successful students.

The study by Lief et al. (1965), cited in previous sections of this chapter, of the characteristics of students ranked academically highest and lowest in their class at the end of the first year, reported Rorschach data in a general, prose description. They indicated "a general trend for the lower group to show more signs of inhibition and rigidity" (p. 117). However, the authors felt that the results could not unequivocally be interpreted as basic personality differences but rather should be interpreted as a specific reaction to the Rorschach task for students aware of their low academic position and attempting to control their resultant anxiety.

Structured Personality Tests And Medical School Performance

Two conclusions become evident from reading the literature on the relationships of personality tests to medical school admissions: (1) that personality traits, as measured by structured tests, are of at least equal importance with cognitive qualities in predicting medical school performance and (2) that structured personality tests, are less

time-consuming and costly than most other techniques for measuring personality traits and are therefore more feasible for the admissions process.

The comparison is essentially with the interview and letters of recommendation, since these are the other sources of information directed mainly toward evaluating the personality traits of applicants. While these two techniques may be said to measure "a little bit about a lot of things," what structured personality tests do is focus specifically on one or a few particular traits or concepts. When the particular traits or concepts are those which demonstrate an association with the criterion being predicted, whether medical school or physician performance, personality test scores produce encouraging results in prediction.

As a participant in the AAMC Conference on Personality Measurement in Medical Education, Jackson considers the implications for medical education of recent developments in structured personality assessment (Haley, D'Costa and Schafer, 1971). Another participant, Snow, considered the interaction of personal characteristics and "medical-education treatments" or, in other words, medical school curricula and teaching methods (ibid).

One objection to personality testing in the admissions process is that voiced by Funkenstein (1957) that the stress experienced by the applicant distorts the results of any structured personality test he/she might be required to take. Therefore, alternate uses of personality tests are proposed, including: (a) to test the cultural values which characterize the environment of a medical school by examining student and faculty characteristics, and (b) to sensitize admissions committees to their own unconscious biases.

A study by Fields (1958) refutes the contention that, when personality tests are used in the admissions process, their results are inaccurate, reflecting directly or indirectly the anxiety experienced by the applicant because of the evaluation to which he/she is being subjected. Fields simply readministered the Minnesota Multiphasic Personality Inventory (MMPI) to a group of successful applicants immediately following their admission. By comparing the results to those obtained when the applicant was in the process of being considered, he showed that there were no significant changes on the 10 clinical scales and only one of the three validity scales showed significant shift.

A researcher who has devoted many years to improving the prediction of medical school performance particularly through the use of personality tests, Gough is a University of California-Berkeley psychologist who constructed two tests which appear frequently in the research literature: the California Psychological Inventory (CPI) and the Adjective Check List (ACL). One of Gough's earlier forays into the selection literature

was an overview of studies evaluating the predictive validity of cognitive selectors (Gough, Hall and Harris, 1963). The conclusion was drawn that such criteria are inadequate and other factors are more important.

This article was followed by one which demonstrated the superiority of the CPI over cognitive criteria for predicting medical school performance (Gough and Hall, 1964). First, the CPI and MCAT scores of 34 students entering the University of California-San Francisco School of Medicine in 1954 were compared with those of 66 rejected applicants. The only significant differences which appeared were on the CPI Socialization scale and the MCAT-Quantitative subtest. The general overall lack of differences was taken by the authors as evidence of the low weighting assigned to these two tests (CPI and MCAT) by the admissions committee. The analysis then focuses on the accepted students and on predicting their yearly medical school GPA, overall GPA and faculty ratings on performance and potentiality. These 6 criteria were correlated with the 3 predictors: CPI, MCAT and premed GPA.

The resulting coefficients were all low and nonsignificant except for those between the CPI Sociability scale and third-year, fourth-year and overall GPA which were significant at the .05 level and between Sociability and faculty ratings, significant at the .01 level. One wonders whether these results point to the assignment of grades as a reflection of a general impression of performance and potentiality by faculty and whether that general impression is based, in large part, on the student's likeability. This conjecture seems to be supported by the results of the intercorrelations of the 6 criteria with themselves in the present study. All of these intercorrelations were significant except that between first-year GPA and faculty ratings and that between first-year and fourth year GPA's.

The study then proceeded to derive two regression equations for each of the 6 criteria, one of the 2 equations using the 4 MCAT scores as the predictors and the other equation using 4 CPI scales (Sociability, Tolerance, Communality and Status Potential) as the predictors. The point of deriving these equations was to determine how much of the variation in the criterion was accounted for by the predictors included in the equation to the exclusion of other factors. Thus, two different predictions of each criterion could be made, one purely on the basis of weights for the MCAT and the other purely from the weights assigned for the CPI. The two sets of "pure" prediction scores were then correlated with the actual criteria to demonstrate which of the two predictors (CPI or MCAT) showed a greater relationship to the 6 different criteria. The coefficients for the correlations between the CPI-predicted criteria and the actual criteria ranged from +.49 (criterion - overall GPA) to +.66 (criterion - faculty ratings). The coefficients for the correlations between the MCAT-predicted and the actual criteria ranged in absolute size from .06 (criterion - third year GPA) to only -.28 (criterion - first year GPA). There was a negative relationship (-.18) between the MCAT-

predicted and actual faculty ratings.

The results were cross validated on another sample of San Francisco medical student seniors (n = 63) for which CPI correlated +.46 with fourth-year GPA ($p < .01$), while MCAT scales correlated +.03 to +.23 and premed GPA correlated +.18. In a final step, the authors employ the empirically-based CPI prediction equation to derive profiles of high and low CPI scorers. The profile of the successful medical student is "one of unselfishness and consideration of others, rather than of need for achievement, striving, intellectuality, creativity or personal aggrandizement."

Gough's other test, the Adjective Check List (ACL), is the non-cognitive predictor in a recent study (Gough and Hall, 1975b). The study distinguishes academic from clinical performance in medical school through the statistical factoring of yearly grades and faculty ratings. The clinical performance factor, which is the larger component of medical school performance, was essentially unpredictable from the MCAT and GPA, but was marginally predictable from the ACL. The MCAT and GPA acceptably predict the academic performance factor.

The operational definition of the criterion in Gough's studies becomes progressively grosser over the years. He begins by using yearly GPA and faculty ratings, steps down to overall academic vs. clinical performance and then steps down again to graduation vs. dropping out from medical school. In the latter case (Gough and Hall, 1975a), predictors from the MCAT, GPA, interview, ACL and CPI are correlated with the graduation/dropout criterion for 1,014 University of California-San Francisco graduates, 40 non-academic dropouts and 17 academic dropouts.

Out of 49 predictor variables, significant coefficients were obtained for MCAT-Quantitative, science GPA, last year GPA, ACL-Nurturance, Heterosexuality, Succorance, CPI-Responsibility, Socialization, Communality and Femininity (for male subjects). The interview rating did not correlate significantly with the graduation/dropping out hierarchy, but that which was evidenced was in the negative direction. The authors reproduce the same type of regression analyses as in their 1964 study for each of the three groups of students: graduates, academic and non-academic dropouts. The scores predicted from the regression equations were significantly different between the groups. The best predicting equation was based on MCAT-Quantitative, last year GPA and CPI-Status, Socialization and Communality (all weighted positively) and CPI-Achievement via Conformity (weighted negatively).

An autobiographical checklist constructed by Beiser and Allender (1964), which included demographic and biographic variables, interests and career plans, was felt by the authors to distinguish three personality types of medical students: "strivers", "individualists" and "unrealists". Achievement was categorized into overachievement, high, average, low and underachievement on the basis of MCAT - first year medical school GPA congruence or disparity. Forty-three percent (43%) of the unrealists were low- or underachievers compared to 21% of strivers and 16% of individualists. The study is based on 200 University of Illinois-Chicago medical students. Following up on these students three years later, the senior author (Beiser, 1967) shows that the three types of students continue in their different patterns of medical school achievement.

Using the Thurstone Temperament Schedule, as a measure of drive or motivation, in combination with MCAT scores, Morris (1958) successfully predicted medical school achievement. In a subsequent study (1971), three structured personality tests were employed, the Thurstone Temperament Schedule (TTS), the Edwards Personal Preference Schedule (EPPS) and the Allport-Vernon Lindzey Study of Values (AVL). The noncognitive predictors were related to MCAT-Verbal and Quantitative scores; to first year, second year and fourth year medical school GPA's; and to "deviations of grades from those which would have been predicted by the two MCAT scores separately" (p. 608). Morris summarized his results as follows:

1. Need-exhibition and need-autonomy of the 17 Edwards Personal Preference Schedule variables were significantly positively related to achievement in medical school. Need-achievement yielded a low positive correlation with actual achievement at the end of the first and second years and reached a correlation significant at the 5 per cent level with the students at the end of four years of medical school.

2. There were no significant relationships between the Thurstone Temperament Schedule variables and achievement; although the "Sociable" factor was consistently negatively correlated with achievement.

3. On the Allport-Vernon-Lindzey Study of Values, the "Aesthetic" value score correlated positively and the "Religion" value score correlated negatively with achievement.

4. Medical College Admissions Test Verbal Ability "Deviation" scores produced only one set of significant correlations with the nonintellectual factors. This was a negative correlation with the Thurstone Temperament Schedule "Reflective" scale. This suggests that as actual medical grades deviate from predicted grades, there is a reverse relationship with the Thurstone Temperament Schedule "Reflective" score. Thus, over-achieving tends to be related to the type of person who likes to deal with particular problems while the under-achieving person tends to "like meditative and reflective thinking and enjoys dealing with theoretical rather than practical problems."

5. Grades deviating from predictions based on Quantitative Ability scores were positively related to the Edwards Personal Preference Schedule "Need-Exhibition" scale and to the Allport-Vernon-Lindzey "Theoretical" value scale. These findings suggest that grades deviate toward "over-achievement" in persons who "like to say witty and clever things, tell amusing jokes and stories,...to be the center of attention,...etc. They also suggest a positive relationship with scores which characterize people whose interests "are empirical, critical and rational--whose chief aim in life is to order and systematize his knowledge." (pp. 609-610).

Other researchers have employed different single tests and varying assortments of several tests to predict different criteria. Solkoff (1968) at the State University of New York-Buffalo examined the utility of a veritable grab-bag of predictors -- MMPI, Group Rorschach, Wesley Rigidity Index, Scale of Social Responsibility, Eron's Humanitarianism and Cynicism Scales and the Authoritarianism Scale -- and concluded that none were sufficiently reliable to be used for actual selection. McDonald and Bynther (1963) found the EPPS and the Interpersonal Checklist (IPL) to correlate with academic achievement at the Medical College of South Carolina. Academic dropouts were significantly distinguished from the rest of their class at the University of Nebraska Medical School and nonacademic dropouts were shown to have an unique pattern of scores by the ACE Psychological Examination (Wolpin and Garfield, 1960).

Five factors of medical school performance did not correlate especially well with the Strong Vocational Interest Blank and the 16 Personality Factor Inventory for University of Michigan medical students (Kelly, 1957b). Barratt and White (1969) showed that University of Texas-Galveston students with similar MCAT scores but different levels of anxiety and impulsiveness (as measured by the IPAT Anxiety Scale and the Barratt Impulsiveness Scale) had different mean GPA's in medical school. Also, included in this study as predictors were the Guilford-Zimmerman Temperament Survey, the 16 Personality Factors Inventory, Barron's Ego Strength Scale, the Clyde Mood Scale and Plutchik's Emotions Profile Index. These latter predictors did not show significant relationships to medical school achievement.

Rosinski (1963) developed a seven scale test of the professional, ethical and intellectual attitudes of medical students. Testing two years' classes of freshmen and seniors at the Medical College of Virginia, no differences between the freshmen or the seniors were found, showing that the test was reliable. The author also found no differences between the freshmen and seniors and interpreted this as evidence of the failure of the medical school to instill appropriate attitudes in its students. However, another interpretation, not considered by the author, is that the attitudes measured by the test are too basic to be altered by only four years of medical school. If this latter possibility is true, it increases the value of the test for selection.

In a later study examining social class differences on this same attitude inventory (Rosinski's Medical Student Attitude Inventory) and other measures as well (EPPS, Miller Analogies, MCAT, NBME I and II, and GPA), Dagenais and Rosinski (1975) found no differences in any of these measures except GPA. Lower social class students had higher GPA's, a finding also obtained by Gee (1958). The authors account for the homogeneity of the student body as due to anticipatory socialization and the screening mechanism of the admissions process.

Other studies employing structured personality tests are those by Donovan, Salzman and Allen, 1970; Haley and Lerner, 1972; Haley, Juan and Paiva, 1971; Haley and Paiva, 1969; Horowitz, 1964; Horowitz and Williams, 1964; Ingersoll and Graves, 1965; Johnson and Hutchins, 1966; Mensh and Johnson, 1964; McCaulley, 1972, 1976b; Myers and McCaulley, 1973; Myers and Davis, 1964; Schofield and Merwin, 1966.

In the Korman, Stubblefield and Martin (1968) study of correlates of five factors of performance at the University of Texas, Southeastern Medical School previously cited in this chapter, the CPI, the Edward Personal Preference Schedule (EPPS), self-ratings of basic personality traits, items on a biographical inventory and faculty interview ratings were correlated with the five criterion scores. Achievement in Clinical Medicine showed no significant relationships to any of the nine CPI subscales or to four of the five EPPS subscales. However, Achievement score on the EPPS was significantly correlated (at the .05 level) as was

the Self-Rating of Succorance (r = -.24). Correlations with the other four self-ratings of traits were not significant. Biographic data indicating earlier school and home difficulties were significantly related. However, MCAT and GPA were the best and most consistent predictors of the Achievement in Clinical Medicine factor.

The Internship Success factor was not predicted by the CPI or EPPS, but was related to Self-Rating of Affiliation (r = -.26) and of Autonomy (r = +.24) and to biographic data indicating sociability. The Peer Esteem factor was significantly and negatively related to eight of the nine CPI subscales but to none of the EPPS subscales. It was negatively related to the single Self-Rating of Achievement and to biographic data indicating small-town origin, class officer, good parental and home relations.

The Scientist Potential factor was related to the CPI scales of Achievement by Conformity, Achievement by Independence and Psychological-Mindedness (all positively); to the EPPS scales of Dominance, Nurturance, Deference and Affiliation (the latter three negatively related); to Self-Ratings of Achievement and of Exhibition; and to biographic data reporting urban origins, father's education, not earning money early, "open disagreements with parents" and "sickly as adolescent." MCAT and GPA generally correlated higher with this factor than did any of the non-cognitive data. This is the only factor with which the eleven faculty interview ratings showed any significant relationship. Seven of the eleven were related at the .05 or .01 level.

Humanism, the fifth factor in this comprehensive study, was extremely difficult to predict, not correlating significantly with the CPI, the EPPS, Self Ratings, MCAT, GPA, or faculty ratings from the interview. It was related, however, to biographical data indicating larger family size origins, rural background, lack of advanced placement and good home and parental relations, which particularly encouraged independence. (Similar types of biographic interview data relating to the psychology of family and parental relations were shown by Motto (1965) to distinguish between students with different patterns of medical school performance).

A study which employed 60 scores from four personality tests and 6 ability scores to predict a factor of clinical performance was conducted by Turner, Helper and Kriska (1974). The performance factor was statistically derived from ratings of videotapes of third year Ohio State medical skills in attending outpatients. Three ratings were made: communication skills, interpersonal skills and skill in physical examination. The 60 predictor scores were from four commonly used personality tests: the Opinion, Attitude and Interest Survey (OAIS), the Omnibus Personality Inventory (OPI), the Myers-Briggs Type Indicator (MBTI) and the 16 Personality Factor Inventory (16 PF). Correlation coefficients significant at the .05 level were obtained for only five predictors (four of them personality predictors): 16 PF-emotionally stable (r = +.36): OPI-

anxiety level (r = -.29) and response bias (r = -.30); MBTI-judgment-perception (r = +.35); and score of the Physiology subtest of the NBME-Part I (r = +.29). MCAT-Science score correlated negatively at the .10 level of significance.

Structured Personality Tests and Physician Performance

The criterion of clinical performance used by Turner et al. (1974) more closely resembles actual physician, rather than medical school, performance, even though the study was based on third year medical students. As pointed out in the section of this chapter having to do with cognitive selection factors, there are few studies relating admissions data to physician performance. Also, as the review by Barro (1973) shows, the assessment of physician performance is neither highly developed nor frequent.

The research group at the University of Utah headed by Price has devoted many years and much effort to measuring and identifying predictors of physician performance (Price, et al., 1971). However, while predictors based on biographic and demographic information were examined, those yielded by structured personality tests were not.

The sole work in this area seems to be that of Howell (1965, 1966) cited earlier in connection with the MCAT and GPA. Her study comparing USPHS physicians with favorable and unfavorable supervisors' ratings included the California Psychological Inventory (CPI) and the Adjective Check List (ACL). In summarizing Howell's study, Gough (1967) reports:

> Measures of achievement and intellectual ability did not differentiate between the 2 groups, but a large number of personality test scores did distinguish between them, and some of the differentiations were highly significant.
>
> For example, on the CPI the men with favorable comments scored higher on scales for sense of well-being, responsibility, self-control, tolerance, achievement via conformance, and intellectual efficiency. On the adjective check list..., used as a self-report device, the physicians with favorable comments scored higher on the scales for self-control, personal adjustment, nurturance, affiliativeness, and deference; physicians described unfavorably scored higher

> on the scales for self-confidence, liability dominance, autonomy, and agression. Other differences could be mentioned, but the pattern is already apparent: the physicians who were more highly esteemed by their superiors were more adaptive, more self-disciplined, more cooperative, and, one feels compelled to add, more conventional (p. 648).

In summary, the essence of a consideration of the selection factors for medical school lies in the following elements: the short-term criterion, medical school graduation, and the long-term criterion, physician performance; cognitive and noncognitive domains of applicant characteristics; MCAT, GPA, the interview, application materials and structured personality tests as techniques to assess applicant characteristics. The improvement of applicants' cognitive qualifications and medical school responsiveness to societal needs for diversified physician manpower have currently (1) started a shift in the focus of selection from cognitive to noncognitive characteristics; (2) stimulated the development of a new testing program (MCAAP) to assess cognitive abilities and knowledge; and (3) stimulated efforts to better assess noncognitive characteristics.

CHAPTER V

WEIGHTING OF SELECTION FACTORS

There are two major approaches taken by admissions committees to the weighting of selection factors. These approaches, which may be termed implicit and explicit, are reflected in two differing types of research in the area of weighting.

The implicit approach might also be called laissez-faire since committee members are free to weight the application information available to them in any manner they deem appropriate. Research concerned with this approach has, therefore, been directed at post hoc determination of the subjective weightings implicitly given by the committee to the various factors. The primary statistical technique used in this type of research, and particularly suitable for the purpose, is that of regression analysis.

In such analyses the variation in a criterion, whether a ranking of applicants or a decision to interview or to admit, is broken down into separate components attributable to different sources or predictors. The importance of the variance contributed by each predictor is determined and reported as a weight. The analysis also reports a weight reflecting the importance of factors not included in the analysis. This "error term" in the regression equation will refer not only to "noise" or random sources of variance but also to unknown relevant predictors not included as separate terms in the equation in their own right. That these predictors have been excluded is usually due either to a lack of data or to a foreknowledge of their relative unimportance.

The other type of statistical analysis used in post hoc studies of weighting is that of determining, for various selection factors, the statistical significance of differences in accepted and rejected applicants. If the differences are significant, it indicates that admissions committees have been giving weight to those particular factors for which significant differences have been found. What such studies do not yield are numerical indices of the amount of weight given to the various factors, such as are given in regression analytic studies.

Chapter VI focuses on the literature having to do with changes in the characteristics of rejected and accepted applicants as a way of examining changes in the weighting of characteristics and thus of changes in admissions policies. Actually a majority of the studies reviewed in that chapter do not even test differences, but simply report scores, GPA's, etc. Furthermore, such studies of changes over time have not separated the changes in weighting from the real changes in the characteristics of the applicant pool.

The other major approach taken by admissions committees to weighting selection factors is that of explicitly stating, prior to the decision-making step, the weights which the committee wishes to assign. The weights are often applied through the use of cutoff scores and are not as numerically precise as those obtained in post-hoc regression analyses of implicit weights. Research in this area has usually been either (a) survey type, which asks admissions persons whether they considered the various criteria of "much," "some" or "little" importance or (b) concerned with recommending or reporting cutoff points and particular combinations of selection factors.

In the case of survey type research on explicit weighting, it is important to point out that what the admissions person reports about his perception of the importance of a particular selection factor may be quite different from the way he actually weighs that factor in combination with other factors. Since the research on these types of explicit weighting approaches was a forerunner of that concerned with implicit weighting, let us consider it first.

Explicit Weighting

The survey conducted in connection with the 1956 AAMC Fourth Teaching Institute (Gee and Cowles, 1957) again is invaluable in providing baseline data, here, on Institute participants' perceptions of the importance of the various factors used in admissions. Table 4.5 presented these data. Table 5.1 supplements those data with information on stated and actual, institutional policy and reflects the importance or weight given to certain factors. That these are factors involved in screening applicants "seriously considered for admission" implies that there has been some type of first screening on the basis of other factors. Failure at another medical school, age, undergraduate grades, state of residence and previous attendance at a professional school were factors of sufficient importance to the medical schools that policy concerning their weighting existed at from 89% to 47% of the institutions.

Hamberg, Swanson and Dohner (1971) surveyed premedical advisors at 150 representative institutions as to their perceptions of the weights and usefulness assigned to 17 pieces of admissions data by admissions committees. The advisors' ratings were compared to the ratings of admissions officers at 93 medical schools as to their own view of the weight and utility of the same pieces of information. Both groups rated overall GPA and science-math GPA "strongest" and most "useful." The strong-weak continuum would be reflective of the weights given to the various pieces of admissions data.

TABLE 5.1

SCHOOL POLICY ON FACTORS INVOLVED IN SCREENING APPLICANTS SERIOUSLY CONSIDERED FOR ADMISSION

(Participants group)

Influencing factor	% of 91 schools stating policy concerning factor			
	Publicly stated policy	Not stated but existing practice	No policy	No response
A. Negative consideration because of unusually old or young applicant:	18	51	30	1
Maximum age	11	35	40	14
Minimum age	7	25	48	20
B. Sex of applicants:	21	4	33	42
Men only; women only	7	2	68	23
Percent of applicants of each sex	2	8	53	37
Percent of each sex enrolled	3	10	50	37
C. Marital status	1	6	81	12
D. U.S. citizenship preferred	9	35	40	16
E. U.S. citizenship required	9	6	50	35
F. Negative consideration because of previous attendance at professional school:	11	36	49	4
Pharmacy	8	16	74	2
Dentistry	8	18	71	3
Veterinary medicine	8	13	77	2
Osteopathy	7	31	59	3
Nursing (B.S. degree)	6	13	79	2
Graduate school	3	2	89	6
G. Premedical course of study: Specific premedical programs over and beyond stated premedical requirements are preferred	19	13	64	4
H. Required minimum in college grades	33	36	30	1
I. Failure at another medical school	31	58	9	2
J. State of permanent residence	44	11	43	2
K. Preference given to:				
1. Children of physicians	1	13	84	2
2. Relatives of alumni	8	15	76	1
3. Relatives of faculty	2	17	80	1
4. Students from selected colleges	1	31	67	1

Source: Gee and Cowles, 1957, p. 201.

The two groups were in very close agreement on 14 of the 17 pieces of data, but admissions officers rated MCAT-Verbal, MCAT-General Information and family background as having significantly weaker weights than did the advisors. It is expected that the admissions officers would have more accurate perceptions of the actual weights given to the various factors. The ranking of the factors they weighed most heavily was: overall GPA, science-math GPA, MCAT-Science, committee letters, advisors' letters, interview, MCAT-Quantitative and professors' letters. However, almost equal ratings were assigned to these eight factors. The officers weighted as weakest ethnic background, family background and "other letters" (i.e. other than letters of recommendation or letters from professors, committees or advisors). Weighted by them as next weakest was the MCAT-General Information subtest.

In a somewhat-unstructured questionnaire survey of the deans of 112 U.S. medical schools (to which the admissions officers of only 48 institutions responded) Haning, McDermott, Char and Hansen (1973) found almost uniform reliance upon three sole parameters: GPA, MCAT and the interview. Attitudes toward letters of recommendation were mixed. Only 3 schools used a structured personality test, while one used an intelligence test to supplement the MCAT (10 schools expressing dissatisfaction with the MCAT's predictive capability). "Seven schools regarded the interview as of little or no importance, and one does no interviews prior to admissions... Seven schools acknowledged the interview directly as 'very important' in the selection process, regarding the importance of the evaluation as equal to or greater than either GPA or MCAT... Ten respondents currently use some form of algebraic formula to produce a score for each candidate, with variables for GPA, MCAT, age, personality traits (from the interview or subjective tests, etc.)... 25 of the 48 respondents (52%) provide 'work sheets' with varying data on the applicants to each committee member." Results of the survey also found a general lack of structured interviewing procedures, "with several shining exceptions" and a general inability to define the "good physician" in terms "other than those of a good Boy Scout."

Another survey of explicit perceptions of weighting is that of Mlott and Schachte (1972) to which responses were received from 55 out of the 103 U.S. and Canadian medical schools which were surveyed. The results summarized below provide a general impression of the relative weights given to the various criteria listed by the respondents:

> Thirty-eight of the 55 schools answering this question (69.1%) relied most heavily on grade point average, while 2 (3.6%) thought it of minor importance. Similarly, 38 schools (69.1%) gave most weight to Medical College Admission Test scores, while 5 (9.1%) considered

Conger and Fitz (1963) report similar successful results with a "relatively simple, unweighted formula for predicting success in medical school..., based on the number of admission variables on which an applicant fell in a so-called 'danger range'" (p. 947). The authors suggest that the advantage of using weighted rather than unweighted scores should be examined. However, since "unweighted scores" are in actuality scores which have been "equally weighted," what the authors are calling for is an investigation of the advantages of differentially weighted scores.

Ambrosino and Brading (1973) report on "an analytical computer-based methodology for screening medical school applicants" to the Albany Medical College. Their methodology involves simply the computer calculation, rather than the human calculation, of an average of ratings on 9 predictor variables, with "average" implying an equal weighting of factors. The average is used to determine whether applicants will be invited for an interview, rejected outright or held as marginal.

A system which differentially weights admissions factors at Marquette Medical School is reported by Rimm, Pazdral and Sine (1968). "The system weights undergraduate performance variables as follows: average Medical College Admission Test (MCAT) score, 40 percent; premedical grade-point average (GPA), 30 percent; undergraduate college, 20 percent; and maturity ratio, 10 percent." The index of undergraduate performance which results is then used to "queue" applicants for an interview and/or other types of further consideration.

Another example of an explicit system for differentially weighting admissions factors is that developed for selecting students for Florida State's Program in Medical Sciences (Elliott, 1975). The weights employed in the Programmed Information Management System ($PIMS^2$) model, both to combine factors and to categorize applicants on each factor, reflect the commitment of the program "to select students with a propensity for primary care medicine, particularly for rural and inner city under-served areas, and to increase opportunities for minority students within the practice of medicine." The model gives 44% of the total weight to academic factors and 56% to nonacademic factors. Since the model is not widely available and since it is the sole known example of such a precisely-defined explicit weighting system, it has been reproduced in Figure 5.1.

An extremely fruitful approach to establishing the weights which should be applied to admissions factors was taken by Schofield and Merwin (1966). After examining the correlations between various predictors and the 2 criteria of first two years medical school GPA and of third year GPA, those predictors showing the greatest association with the criteria were entered into multiple correlation and regression

Figure 5.1

PROGRAM IN MEDICAL SCIENCES

PROGRAMMED INFORMATION MANAGEMENT SYSTEM

SELECTION MODEL

$$8(GPA)^2 + 4(MF)^2 + 3R^2 + 2S^2 + 3G^2 + M + 2D^2 + 2Q^2 + 3I^2 \pm A^2$$

DEFINITION OF VARIABLES:

GPA - Grade Point Average Formula
MF - MCAT Formula (High School Placement Test Equivalency Formula)
R - Faculty Recommendations
S - Socioeconomic Rating
G - Demographic Rating
M - Myers Briggs Type Indicator Sensing Scale
D - Academic Distinctions
Q - Nonacademic Qualifications
I - Interviews
A - Discrepancy Evaluation (not in present use)

Δ = GPA - last three quarters (average) MINUS
GPA - preceding three quarters (average)

$$\underline{GPA} = \left(\frac{GPA_{overall} + GPA_{science}}{2} \pm \frac{\Delta\ gpa}{3} \right)$$

$$\underline{MCAT} = 10^{-2} \left[\left(\frac{Verbal + 2Quantitative + General\ Information + 2Science}{6} \right) - 300 \right]$$

or

$$\underline{High\ School\ Placement\ Test} = 10^{-2} \left[\left(\frac{5.4(A + E + S) + 2(8.1 \times N_s) + 2(8.1 \times M_s)}{6} \right) - 300 \right]$$

A = Aptitude E = English S - Social Studies N = Natural Science M = Mathematics

Faculty Recommendations

Rated on a 1-5 scale by staff member in the Program in Medical Sciences Office. Average of 3+ recommendations from junior college or university faculty. (Note that .5 is subtracted from score for any recommendation missing. Minimum = 3)

Teitelbaum, Einstein and Rex (1973) describe the design and implementation of a "quantitative system of admissions" to the College of Human Medicine at Michigan State University in which an Application Rating Form for each applicant is used. An administrative staff member rated each applicant on (1) GPA, (2) MCAT, (3) geographical origin, (4) level of education, (5) MSU attendance, (6) colleges attended, (7) academic honors, (8) extracurricular activities, (9) employment and (10) personal statement. Other than indicating that rural geographic origin is given a high weighting, the weights or ways in which the various data were rated are not explained. Applicants who receive 36 points or more (out of a possible 65) are sent a second application form requesting letters of recommendation. (Those with scores of 31-35 are placed in a hold category.) Thus, letters of recommendation, coming at the second level of screening, carry more weight than do the 10 items upon which the initial screening is based. The MSU system also includes a third admissions stage in which those applicants surviving the second screening, which is based on letters of recommendation and data from the supplementary application form, are interviewed. Again, by implication, the interview is given more weight than are letters of recommendation. Those 90 applicants with the highest score based on all factors are accepted.

This type of composite weighting of the various admissions factors was first proposed by Johnson (1960) in an article describing an "actuarial approach" to selecting students. The predictive validities of the single selection factors of age, sex, marital status, years of undergraduate education, undergraduate major, premedical advisors' ratings and interviewers' impressions were examined. It was then shown that, by rating the applicant on a composite of his scores in each aspect of selection, rather than weighting each factor individually, a more accurate prediction of his/her probable success in medical school results. The importance of weighting the applicant's undergraduate grade record by the caliber of the institution attended is also noted, as is the value of using patterns of MCAT subscores to predict success in medical school.

A subsequent article (Johnson, 1962) reported on the utility of an even more sophisticated "multifactor method" for predicting medical school completion. An experimental rating sheet incorporating 10 pieces of information was completed for 927 applicants interviewed for admission to the 1956-1960 entering classes of the State University of New York-Syracuse Upstate Medical Center. The ten separate factors were combined into a single index based on equal weightings of the factors and it was shown that the multifactor index identified twice as many failing students as did the single predictors weighted separately.

them least important. Interview data were emphasized by 28 schools (50.9%), and 2 schools (3.6%) thought them negligible. Recommendations from applicants' former teachers were relied upon by 22 schools (40.0%), and recommendations from pre-medical advisors were considered very important by 20 schools (36.4%). Fifteen schools (27.3%) deemed the applicant's motivation toward the study of medicine most important. A total of 89 criteria were listed by the medical schools answering this question (p. 320).

Reports on the admissions process at individual medical schools also give a picture of the way in which selection factors are weighed. Marvin (1974) reports that an application file for a student applying to the University of Arkansas Medical School is opened only upon confirmation of Arkansas residency, which can be interpreted as the highest possible weighting of this factor. Each member of the admissions committee rates the applicant on a seven-point scale after reviewing his file. The ratings are averaged over committee members and the 121 with the highest average ratings are accepted and the next 15 to 25 are given alternate status. The file contains 8 items: (1) AMCAS application form; (2) residency status form and statement of the residency status committee's decision; (3) transcripts and certifications of degrees received; (4) MCAT scores and test dates; (5) premedical evaluations from either or both individual faculty or advisory committees; (6) one or more medical school faculty evaluations; (7) MMPI results and results of psychiatric interview, if MMPI significantly abnormal; and (8) other letters of evaluation.

That both explicit and implicit weighting are carried on in the same admission process is evident in the fact that each committee member analyzes the file according to his/her own dictates, but "certain factors seem to be generally accepted." No negative selection importance is given to college major, and financial resources are totally disregarded, while completion of more than 3 years of premedical education is considered advantageous. "It seems obvious that parental occupation or profession, social status, political influence or family status should be irrelevant factors in judging the admissibility of applicants" (p. 85). The author makes a point which recurs throughout the medical school admissions literature: "Dissatisfaction with the current subordination of personal attributes to grades as admission criteria has been smouldering for some time in the minds of applicants, admissions officers, medical school faculty, and other interested and affected persons" (p. 87). He notes that MCAAP is presently attempting to solve the problem.

Figure 5.1 (continued)

Socioeconomic Rating

Taken from McGuire-White, Index of Social Status - determined by weighted values for parent's occupation, source of income, and education.

Upper-lower/Lower-middle class - 5
Lower-lower/Upper-middle class - 4
Upper class - 3

Demographic Rating

Rural, small town, inner city - (9,999) - 5
Large town - (49,999) - 4
Small city - (99,999) - 3
Smaller metropolitan area, suburb, or large metropolitan area + MBTA Sensing - 2
Smaller metropolitan area, suburb, or large metropolitan area without MBTI Sensing - 1

Myers Briggs Type Indicator Sensing Scale

Twenty-five points added to Model score for Sensing variable on the MBTI. If not Sensing, add one point.

Academic Distinctions

Rated by a 1-5 scale on the Interview Report during or immediately after student interview. Selection committee members determine variables to be included in this category through information included in the Biographical Questionnaire as well as during interview, i.e.

large number of hours
independent honors
independent study
difficult courseload
honor societies
rising GPA

Nonacademic Qualifications

Rated by a 1-5 scale on the Interview Report during or immediately after student interview. Selection committee members determine variables to be included in this category.

Interviews

Rated on a 1-5 scale during or immediately after interview. Variables to be included in this category are listed on the Interview Report, i.e.

integrity and maturity
personality
motivation

Source: Elliott, 1975.

analyses to determine the weights which would optimize their prediction of the criteria. "Thus, to maximize the accuracy of predictions of medical school grades for these groups, the premedical academic performance of the student should be given relatively more consideration if either personality or interest variables are deviant and relatively less weight if he achieves favorable measures in these 2 areas" (pp. 506-507).

In a second phase of this study, the prediction equations developed in the first phase were cross-validated on another class of University of Minnesota Medical School students. Contrary to normal expectations of a "shrinkage" in the correlation coefficients, the cross-validation coefficients were consistently slightly higher than the original coefficients. In a third and final phase of the study, the equation-predicted performance of a class of students was compared to their actual first year performance. This was done for each of the three groups ranked by the admissions committee as high, average and low. No significant differences were obtained.

A later study by the senior author (Schofield, 1970) further validates the prediction equations and demonstrates that "despite the considerable amount of additional information (biographical data, references, etc.) available to the Committee, its collective judgments rested so heavily on academic characteristics that the resulting selections closely match those from Pool C which were based exclusively on an index reflecting the optimal statistical weighting of GPA and MCAT scores" (p. 741).

Best, Diekama, Fisher and Smith (1971) used stepwise multiple regression techniques on 10 criteria and 14 predictors to derive prediction equations. "A recommended prediction equation...gives approximately equal weight to premedical grade-point average, type of college attended, quantitative MCAT score, and science MCAT" (p. 50). The authors conclude that "precision of prediction is in no case very great" (ibid.).

Another approach to determining the optimal weights which should be explicitly applied to admissions factors is that of the "discriminant function" (Cullen, 1974). This approach which is based on stepwise multiple regression techniques, first selects the predictor having the highest correlation with the criterion, then that having the next highest correlation, etc. and determines the weights of those predictors.

Milstein, Burrow, Wilkinson and Kessen (1976) compare the accuracy of the discriminant model, which is a linear approach, to a decision tree model for predicting the decision to interview applicants to the Yale School of Medicine. They demonstrate that "the two multivariate procedures perform about equally well (approximately 77 percent correct

predictions overall for the class of 1976 sample and 70 percent for the 1977 replication)" (p. 632). The tree model (Sondquist's "Automatic Interaction Detection (AID) technique) is based on the use of cut-off scores as first proposed by Johnson (1960, 1962) in his articles on "actuarial" and "multifactor" methods. "AID chooses an independent variable and a splitting value which best predict the sample members' scores on the criterion variable (for example, interview/reject decision)" (p. 628), proceeding in a similar fashion with other variables or predictors to subdivide previously obtained groupings. The equation with the weightings of the predictive factors which was obtained through the discriminant analysis is as follows:

$$Y = .659\ (GPA) + .649\ (MCAT\text{-}Verbal) + .142\ (MCAT\text{-}Quantitative).$$

The tree model is reproduced in Figure 5.2.

Weisman, Weinberg and Winstel (1972) demonstrate the construction of another mathematical decision model into which can be plugged whatever weights and factors are desired as a reflection of the committee's philosophy. While this intuitive assignment of weights does not acknowledge the work of those such as Schofield who have attempted to determine the weights which optimally predict actual performance, the authors feel that the advantage of their model (and one can conclude by extrapolation, all mathematical models) is the uniformity of weighting for all applicants which results. Independent of the weights they give to various factors, the authors contend that admissions committees fail to apply those weights uniformly due to a lack of frame of reference. Therefore committee members rely too heavily on MCAT scores and GPA. A mathematical model would provide a stable uniform application of weights. Jason (1972), in rebuttal to this study, strongly decries the use of such models, because he feels they will be used to perpetuate the overemphasis on cognitive criteria.

Implicit Weighting

Implicit weighting of selection factors characterizes those admissions processes in which committees rely upon their own intuitive weighting of the admissions information available to them to decide whether to admit or reject an applicant. However, implicit weighting can also be an element in those admissions procedures in which explicit numerical formulae or models are used. Such procedures usually involve several phases or stages, with implicit weighting usually occuring in the last stage -- i.e. the point where committee members make final admissions decisions on a pool of applicants culled from the larger total applicant

FIGURE 5.2.

AID Prediction Tree

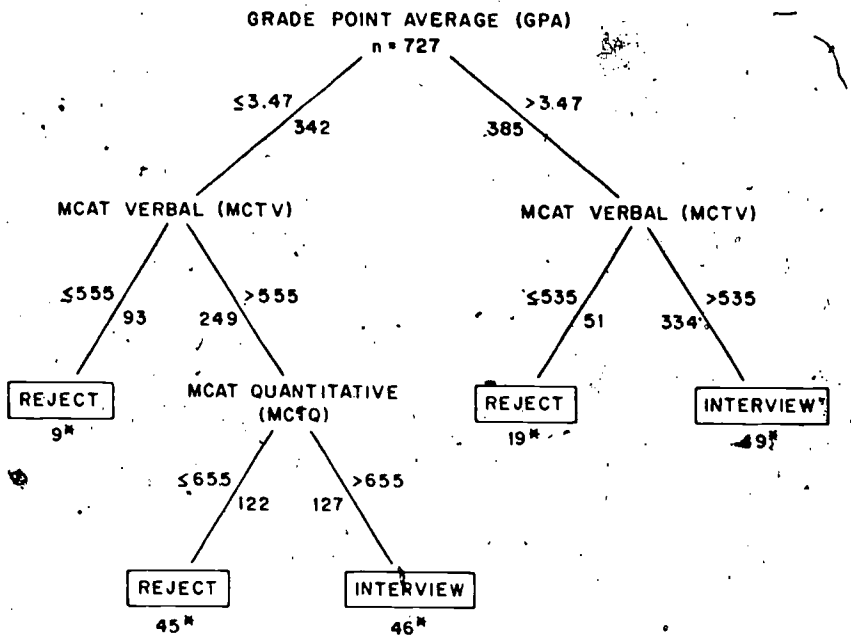


FIGURE 1

AID prediction tree for outcomes of the first stage (screening) of a medical school admission procedure. Split-point values for a variable are indicated on the undersides of the branches extending from it. Outcome categories are encircled at the end of terminal branches. The number of incorrect predictions at these points is denoted by an asterisk. The number under the variable at the top of the tree indicates the total n, and the distribution of cases in the tree is indicated by the numbers on the undersides of the branches.

Source: Milstein et al., 1976, p. 629.

pool on the basis of the explicit formula or model. (The implementation of models is increasingly being accomplished through the use of computers as described in Chapter II).

Research investigating implicit weighting is, by definition, post hoc in nature, attempting to determine the factors and their weights which account for a series of decisions or outcomes. The most efficient and precise technique for determining the criteria and weights is regression analysis. Bivariate correlational analysis will, in the present context, be considered a special case of regression analysis; and while it does not yield weights, does give an indication of the degree of association between a predictor and an admissions index or outcome.

In contrast to regression/correlation is the inferential technique of testing the statistical significance of differences between accepted and rejected applicants. In such analyses, those factors for which significant differences are found are inferred to have been given "more" weight than factors demonstrating little or no difference. The problem with this type of analysis, of course, is that one cannot say precisely how much "more" weight these factors have been given. With this framework of analytic techniques in mind, let us consider the few studies in the literature which have been concerned with implicit weighting in the admissions process.

As part of a large scale study, Carter, Chu, Koehler, Slighton and Williams (1974) examined, in an interim report, the process of student selection in a single, publicly supported medical school by means of a regression analytic technique. Three separate analyses were carried out: (1) for 466 students entering in 1969, (2) for 172 minority students entering in 1974 and (3) for 818 nonminority students entering in 1972. The rationale for partitioning the more recently entering class was that their admission was decided by two separate committees and that they were selected by "criteria that are said to be different" (p. 28).

The results of the three analyses (the 3 prediction equations) were all highly significant ($p < .0001$). They show that, for the 1969 entrants, the following predictors were all positively and highly ($p < .01$) related to admission: science GPA, nonscience GPA, state-residence and selectivity of undergraduate college. (They have been listed here in order of the degree of their relationship to admission, with science GPA showing the highest relationship.) Five other predictors were also related to admission ($p < .05$): female, same undergraduate school, MCAT-Science, MCAT-Quantitative and MCAT-Verbal (female and MCAT-Science weighed negatively).

For neither the minority or nonminority students entering in 1972 were nonscience GPA, MCAT-Quantitative, female or same undergraduate school weighted significantly, as they had been in 1969. Differences in the significance of weights for minorities and for nonminorities were such that science hours and MCAT-Science were weighted significantly for minorities, but not for nonminorities. Conversely, MCAT-Verbal, selectivity of undergraduate college and state-residence were weighted significantly for nonminorities, but not so for minorities. The study further demonstrates the probability that an hypothetical minority candidate with scores one-half standard deviation above the minority mean and evaluated by the nonminority factors and weights would have a .0047 chance of being admitted. A nonminority candidate with scores one-half deviation above the nonminority mean and evaluated by the minority equation would have a .86 chance of being admitted. The same minority candidate evaluated on the minority equation has a .53 chance of admission, while the same nonminority candidate evaluated by the nonminority equation has a .057 chance.

In a followup to this study (Cooper, Lee and Williams, 1976), the same type of analysis is carried out for the applicants accepted for admission at 10 representative medical schools for the years 1973 to 1975. Prediction equations for each of the ten schools were derived for nonminority students for each year and, because of their small number, for minority students for the three years combined. A total of 40 equations were derived. Again, the prediction equations were highly significant ($p < .0001$).

General patterns in the followup study results for nonminorities attest to the continued and consistent heavy weighting of science GPA and the increasingly heavier weighting of state-residence. "The next most consistently significant variables in the prediction of the admission outcomes are: being a graduate from the same undergraduate school, score on science MCAT, and the quality of undergraduate school attended. These variables are highly correlated with each other as well as with the science GPA" (p. 43). The minority analysis demonstrated that, for 9 of the 10 schools, science GPA is given significant positive weight and, for 8 schools, so is MCAT-Science. Six schools gave significant weight to state-residence; and nine schools gave significant positive weight to being Black-Afro/American as opposed to being a member of another minority group.

Zeroing in on the factor of state-residence, Rolph and Williams (1976) use the same techniques to demonstrate that the effect of this factor varies from state to state, given the same applicant credentials. Taking the analysis one step further, the authors show that the strength of the state-residence effect is significantly related to the state's number of medical school places, physician-to-population ratio and per capita income.

Using a bivariate correlational approach, Calkins, Richards, McCanse, Burgess and Willoughby (1974) evaluated an innovative procedure for selecting students for the six year BA/MD program at the University of Missouri-Kansas City School of Medicine. Eighteen predictors were each correlated with a criterion, the "Council Index." The Council Index was the average of the ratings given to each applicant by the members of the Council on Selection. The Council had no knowledge of the student's class rank, test scores, or chance of success as predicted by the admissions director and registrar (DAR). Separate correlation matrices were computed for the 162 applicants in 1972, the 241 applicants in 1973 and the 395 applicants in 1974. Significant correlations for all these years were obtained for the following factors: nonacademic achievement, health-related job experience, class rank, admission test scores, reference ratings, DAR chance of success, rating by a physician interviewer, recommended decision by physician interviewer, rating by nonphysician interviewer and recommended decision by nonphysician interviewer. The last four factors consistently had the highest correlations, indicating their heavier weighting in the Council Index. Race was significantly weighted in 1972 (discriminating against nonwhites) but was nonsignificantly weighted in the opposite direction for 1973 and 1974. Sex was significantly weighted to discriminate against females in 1973 and 1974.

Using the inferential method of testing the significance of differences between 109 students accepted for admission at Michigan State University and 100 students randomly chosen from those who passed through an initial screening on the basis of academic credentials but who were not invited to interview, Elstein and Teitelbaum (1974) examined 6 admissions factors. Significant t-values showed that the accepted and rejected students were significantly different in their personal statements and in their "first screen points," but similar on GPA, MCAT, academic honors and letters of recommendation. "First screen points" refer to the sum of points on GPA, MCAT, academic honors and personal statement. From these results it would seem that the personal statement makes a crucial difference for applicants since it is weighted highly by itself and in combination with the measures of cognitive ability and achievement.

Dresden, Collins and Roessler (1975) give a detailed report on the differences between accepted and rejected minority and nonminority applicants to the Baylor School of Medicine in 1974. Because the numbers of blacks and Mexican-Americans who applied and who were accepted were almost equal, differences are reported for three groups: nonminorities, blacks and Mexican-Americans. The number of acceptees were 132, 13 and 14, respectively; while the number of rejectees were 220, 10 and 16, respectively. Differences on 2 cognitive criteria, 2 demographic variables and 7 structured personality tests were reported.

Generally the results showed that cognitive criteria were used to a much greater extent in selecting nonminority students than in selecting minority students. On 59 noncognitive traits as measured by the 7 tests, nonminorities showed only 5 significant differences, while blacks showed 12 and Mexican-Americans 18. Specifically, there were significant differences between acceptees and rejectees on all 4 of the MCAT subtests for nonminority and Mexican-American applicants; there were no significant differences on the Quantitative and Science subtests between black accepted and rejected students. Cumulative, science and non-science GPA's were significantly different within the nonminority group; none of the three were different in the black applicants and only science GPA distinguished Mexican-American accepted from rejected students. On most of the 7 MCAT and GPA indices, blacks had lower mean scores than did the Mexican-Americans, while the latter had lower mean scores than did the nonminorities.

Birth order showed no differences within the nonminority and black groups, but did show differences among the Mexican-Americans, where the accepted tended to be older than their siblings while those rejected tended to be among the younger children in their family. Nonminority and Mexican-American acceptees were younger than those rejected in each of the two groups. While there was little difference in age between the two black groups, those blacks who were accepted were, on the average, more than 18 months older than acceptees from the nonminority and Mexican-American groups.

On nine scales of the Edwards Personal Preference Schedule, the number of significant differences between accepted and rejected applicants was 3 for nonminorities, 4 for Mexican-Americans and 2 for blacks. On 3 scales of the California Psychological Inventory, the number of differences was 1, 3 and 2, respectively. The Ego Strength scales of the MMPI showed no differences for nonminority or black applicants, but did yield a significant difference between those Mexican-Americans who were accepted and those who were rejected. The same results were obtained on the Extroversion and Lie scales of the Eysenck Personality Inventory. The Kaplan Self-Derogation Scale scores were significantly different only between black accepted and rejected applicants. Out of the 9 scales of the Birkman Attitudes Inventory, none were significantly different between the nonminority groups, 2 were nonsignificant for Mexican-Americans and 5 for blacks. Finally, on the 4 scales of the Birkman Vocational Interests test, nonminorities and Mexican-Americans showed 1 significant difference and blacks showed 3 differences.

Three other studies (Plagge, Sheverbush, Smith and Solomon, 1974; Pearse and Gorelik, 1975; Simon and Covell, 1975), reporting on programs to admit and retain increased numbers of minority students, support the

evidence of the more comprehensive study by Dresden et al. -- that noncognitive factors are weighted more heavily for minorities than for nonminorities. Unfortunately, cognitive criteria still seem to carry more importance than noncognitive factors for admissions committees in their consideration of nonminority applicants. This seems irrational given the cognitive homogeneity of the nonminority applicant pool relative to that of the minority applicant pool.

As a followup to this consideration of significant differences in the characteristics of accepted and rejected applicants, Chapter VI will examine differences or changes over time in applicant characteristics.

CHAPTER VI

CHANGES IN THE CHARACTERISTICS OF ACCEPTED AND REJECTED APPLICANTS

Up to this point we have examined all aspects of the admissions process from the formal logistics of applying to medical school, to the weighting of criteria which goes into determining final decisions. This chapter examines the changes in the characteristics of those whom the admissions process is designed to evaluate: the applicants. Three areas are examined: changes in intellectual characteristics and academic background; changes in personality characteristics; and changes in demographic characteristics. The first area deals with MCAT scores, undergraduate GPA's, and the academic preparation of applicants. The section on personality characteristics deals primarily with data derived from the Myers-Briggs Type Indicator -- the most relevant research found on this subject. The last, and most extensive area includes information on the changes in socio-economic background, geographic origins, sex, race, and age of accepted and rejected applicants. The literature examined for this chapter revealed varying degrees of change within each of these areas. The amount of change within each characteristic of accepted and rejected applicants may to some extent be seen as a reflection of change in the weighting of various criteria (see Chapter V). In addition numerous societal changes have effected the nature of the applicant pool.

Intellectual Characteristics And Academic Background

Over the past twenty years there has been much discussion of the intellectual caliber of medical school applicants and enrollees. Between 1955 and 1965 there was considerable concern that the average applicant was less qualified than in previous decades. Other scientific fields were attracting large numbers of the top college graduates in this era of "Sputnik." Meanwhile the curriculum of medical colleges became more demanding and complex requiring a different type of background preparation for medical students (Funkenstein, 1966a).

A possible explanation for the then rising attrition rate which caused much concern was offered by Funkenstein (1962). Pointing out that there was no evidence of a lowering of admissions standards, he suggested that the problem lay in the gap between the type of highly specialized education that students were now receiving in undergraduate schools and the continually widening amount of information they were expected to know in medical school. "Their deficiencies in preparation

were in two main areas: a) too specialized an education, and b) a lack of certain fundamental skills -- chiefly reading and math" (p. 589).

Moreover, "although the entering medical students and the profession itself have become more specialized, the medical schools have not. They have responded to the rapid increase in knowledge not only by increasing the content of the curricula but by adopting higher academic standards" (p. 590). The problem therefore was not a lack of capable applicants. Instead, there was a need to enhance the appropriateness of an applicant's preparation for medical school, as well as to revise the curricula of medical schools in a manner which would acknowledge the different levels and types of entrant population (Funkenstein, 1962).

These types of problems arise during what Funkenstein (1971) refers to as "transitional eras." Mapping out the changes in medical education in this century, Funkenstein describes four distinct areas. The three of relevance here are: Specialty-Practice Era, 1940-1959; Scientific Era, 1959-1968; and the Community Era, 1968 - (at the time of Funkenstein's report--1971--the Community Era was continuing). Drawing on data from Harvard medical students over the past thirteen years, Funkenstein analyzed the changes which occurred. Students in the Scientific Era showed a marked improvement in scientific training over students in the previous era. Their scientific training was also far more specialized with a marked increase in the percentage of biology, chemistry and physics majors, and a large decrease in premedical majors. Going from the Scientific Era to the Community Era, more students had had social-science majors, and thus tended to show a great deal of interest in human behavior, but science interests still remained strong.

In the transition between each of these periods, there was difficulty in adjusting the admissions process to the different types of students who were applying. The change from the Specialty-Practice to the Scientific era showed mainly just an increase in scientific orientation. But the transition to the Community era brought on many more changes in the applicant pool with an increase in minority and female applicants, as well as a wider range of interests and academic backgrounds. Both Funkenstein (1970) and Perera (1966) warned against continuing to select a homogeneous student body. Instead, they felt, the enrolled students should reflect the diversity of the applicant pool.

Reporting on a study begun in 1963, Matarazzo and Goldstein (1972) further verified Funkenstein's conclusions that the applicants of the 1960's changed in many ways but not in their intellectual caliber. Examining four criteria -- MCAT scores, intelligence quotients, college grades and medical school attrition rates -- the authors found that "the intellectual caliber of today's medical student is at least as high as that of his contemporary 20 years ago, if not slightly higher."

The applicant studies published each year by the AAMC also bear out this contention. They show that since 1955 the average MCAT scores for both accepted and rejected applicants have been slowly but steadily rising (see Table 6.1).

Before turning to the data derived from Table 6.1, it should be noted that MCAT scores for applicants are much narrower than they would be for the general population. This is due in part to the self-selection which occurs in the application process. Many factors come into play which cause the total applicant pool to be of overall high quality and the differences between accepted and rejected applicants are sometimes not very great (McGuire, 1972). For example, the widespread knowledge of the competitiveness of medical school admission may cause many individuals with poor or only moderate academic credentials to refrain from applying. Culver (1971) reported how, with no knowledge of the MCAT scores of one year's applicants, the admissions committee at Harvard admitted a class whose MCAT distribution differed little from that of classes accepted in years when applicants' scores were known.

In spite of the above mentioned qualification, a close examination of the data in Table 6.1 yields some interesting information on the changes in MCAT scores of accepted and rejected applicants over the past twenty years. First of all, for each five year interval one can see that, while the differences between scores of rejected versus accepted applicants never exceeds 84 points, it is more than one half standard deviation in each case. (MCAT scores are standardized on the basis of a mean score of 500 and a standard deviation of 100.) Moreover, between 1955-56 and 1975-76 the increase in scores for accepted students on the Quantitative Ability and Science subscales approaches one standard deviation (the differences being 92 and 93 points respectively). It is interesting to note that the average MCAT scores for rejected applicants in 1975-76 are higher than the comparable scores for 1955-56 accepted applicants for Quantitative Ability and Science and are almost the same for Verbal Ability.

For the five time periods in Table 6.1 the average score differential (between accepted and rejected applicants) is 71 points on the Quantitative Ability section and 74 points on the Science section (the two sections which generally carry the most weight in admissions decisions). Therefore, while the range of scores for applicants to medical school may be narrower than in the general population, clearly the range in scores has allowed some differentiation in the quality of applicants.

The annual education issues of J.A.M.A. provide additional information on the changes in applicant characteristics over the years. Although these data pertain only to accepted applicants, several interesting trends are apparent. First of all, there was little change in the percentages of entering students with grade point averages (GPA's)

TABLE 6.1

Mean MCAT Scores of Accepted and Rejected Applicants

First-Year Class	Verbal Ability	Quantitative Ability	General Information	Science
		ACCEPTED APPLICANTS		
1955-56	524	528	527	522
1960-61	527	533	527	533
1965-66	541	583	565	549
1970-71	559	606	560	558
1975-76	575	620	550	615
		REJECTED APPLICANTS		
1955-56	466	459	476	454
1960-61	464	453	473	449
1965-66	473	502	511	466
1970-71	506	539	518	499
1975-76	522	562	513	539
		DIFFERENCES BETWEEN ACCEPTED AND REJECTED		
1955-56	58	69	51	68
1960-61	63	80	54	84
1965-66	68	81	54	83
1970-71	53	67	42	59
1975-76	53	58	37	76
Average	59	71	48	74

Source: AAMC Yearly Applicant Studies.

of A, B or C during the period 1955-1964 (Table 6.2). But again, there was substantial change in the following ten years (1965-1974) with an increasing proportion of students receiving A's and a decreasing proportion receiving C's. However, it is difficult to ascertain how much of this increase is due to grade inflation over the past ten years, and how much is actually due to an improvement in the caliber of medical applicants.

The formal educational background of accepted applicants has also increased somewhat over the past twenty years. In 1955-56, 75 percent had four years of college education and 70 percent of this group possessed baccaluareate degrees. Ten years later, the proportion of enrolled students who had completed four years of undergraduate education was up to 83 percent, and 90 percent had done so in 1974-75 (AMA, Education Issues of J.A.M.A., 1955-1975).

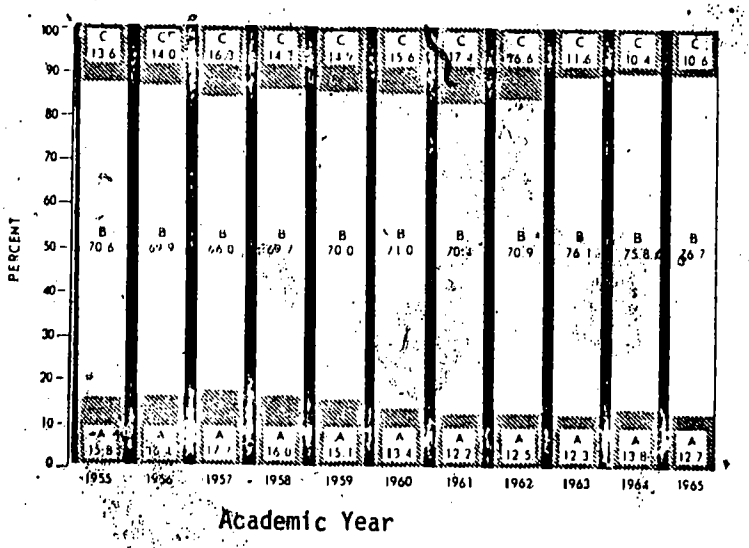
In recent years some controversy has arisen over the differences in cognitive criteria of accepted minority students and accepted white students (Davis, 1976; Cooper, 1976). Table 6.3 indicates that currently differences in the undergraduate grade point averages and mean MCAT scores of Caucasian and Afro-American applicants do exist. However, admissions committees do not base their decisions solely on the basis of these two criteria. Rather, a wide range of non-cognitive criteria come into play (as discussed in Chapter IV); and the more aspects of an applicant's background which are "non-traditional" the less weight is placed on "traditional" criteria. This by no means indicates that minority applicants who are accepted are less qualified overall than their non-minority counterparts. Sedlacek (1974) explains that:

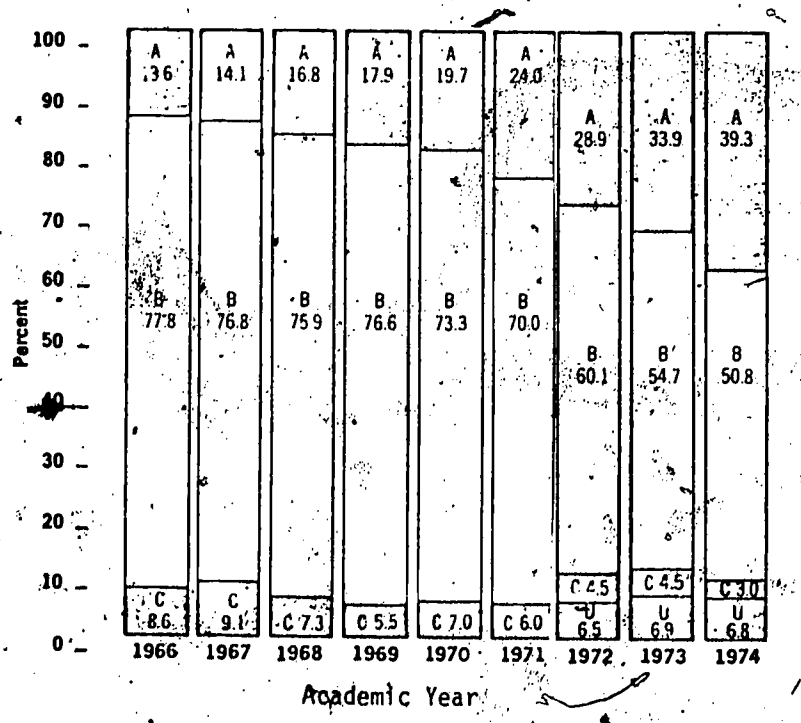
> Recent research indicates that, for minority students, many of the traditional predictors are not optimal indicators of how they will perform at a higher level of education. . . . The term "nontraditional" refers to a unique variable or to a somewhat different use of a traditional predictor. It is important that such nontraditional criteria not be viewed as inferior or deficient. Minority applicants often come from a background which is culturally different and about which a typical admissions committee knows relatively little. To use traditional predictors with such students would be to overlook the potential for medicine that they have shown in terms of their own culture. (p. 31)

Overall it is clear that the test scores and GPA's of medical school applicants have improved since 1955, with the credentials of both accepted and rejected applicants of recent years becoming more impressive than those of their predecessors. With the exception of the controversy over the qualifications of some accepted minority students, the

TABLE 6.2

Comparative Analysis of College Records
of First-Year Medical Students
in Classes Entering 1955 through 1974





Source: J.A.M.A. Education Issues, 1966 and 1976.

TABLE 6.3

MCAT Scores and Undergraduate Grade Point Averages
For 1975-76 Entering Class by Self Description

Applicants By Self Description	Mean MCAT Scores				Mean UG GPA's		
	Verbal	Quant.	Gen. Info.	Science	BCPM	All Other	Total
Black/Afro-American							
Accepted	479	515	466	500	2.77	3.06	2.89
Non-Accepted	411	429	419	391	2.35	2.78	2.55
White/Caucasian							
Accepted	584	629	559	627	3.52	3.52	3.52
Non-Accepted	533	573	523	552	3.06	3.21	3.13

Source: AAMC, Division of Student Studies, 1976.

admissions committees of today need be considerably less concerned about the cognitive qualifications of applicants than they were ten or twenty years ago. Because the applicant pool of today includes an abundant number of students with acceptable MCAT scores and GPA's, admissions committees can now give more attention to noncognitive criteria.

Personality Characteristics

Numerous studies discuss the potential utilization of personality measurements as a criteria for selecting medical students (see Chapter IV). Several studies describe the results of these tests on already-admitted students at individual schools. For example, Donovan, Saltzman and Allen (1970) analyzed the results of the administration of the Allport-Vernon-Lindzey Study of Values (A.V.L.), and the Edwards Personal Preference Schedule (E.P.P.S.) to eight successive classes of students over a six year period (1964-1969) at the University of Rochester School of Medicine and Dentistry. They found that entering classes showed considerable homogeneity from one year to the next. The attrition study by Johnson and Hutchins (1966) on medical school dropouts presents national data on the A.V.L., E.P.P.S., and Strong Vocational Interest Blank of the 2,812 students in the AAMC Longitudinal Study who entered medical school in 1956. Other reports criticize the admissions system for paying too much attention to cognitive criteria and not enough to the personality characteristics of applicants (e.g., Rockwell and Pepitone-Rockwell, 1974).

However, in attempting to specifically address the issue of changes over time in the personality characteristics of accepted and rejected applicants one is faced with a paucity of information. Aside from Funkenstein's research on the eras of medical education (see earlier discussion in this chapter), only the research conducted with the Myers-Briggs Type Indicator pertain directly to this subject.

McCaulley (1976b), of the Center of Applications of Psychological Type, has recently compared her own research to that of Myers which was done in the early 1950's, though not reported until later (Myers and Davis, 1964). Both studies used the Myers-Briggs Type Indicator to assess the distribution of psychological types among medical students. The thesis is that "certain habits of mind, operationally defined by the Indicator, predispose a person to find certain activities satisfying and to choose occupations expected to provide such activities" (Myers and Davis, 1964, p. 1).

The "preferences" which are measured on four continua and the opposing endpoints of each continuum are described as:

I. Sensing: Interest in facts, details, the tangible and immediate.
vs.
Intuition: Interest in possibilities, meanings, relationships, imagination.

II. Thinking: Interest in the analytical, impersonal, logical, cause-and-effect.
vs.
Feeling: Interest in the personal, in what matters to people.

III. Extroversion: Interest in variety, sociability, action, involvement.
vs.
Introversion: Interest in concepts and ideas, getting deeply into problems.

IV. Judging attitude: Interest in order, system planning, schedule.
vs.
Perceptive attitude: Interest in spontaneity, flexibility, curious for change. (McCaulley, 1976b, pp. 1-2)

McCaulley's findings (1976b) show a clear majority of the Intuitive type over the Sensing type, while in the Myer's data of the 1950's the proportion was almost equal. The balance between Thinking and Feeling types was almost equal for both time periods. This is logical considering medicine's need for both scientific and humanistic judgement. Similarly, data from both studies show an equal balance of Extroverts and Introverts. The ratio between Judging and Perceptive types, however, has reversed itself with a higher proportion of today's students being Judging types.

These changes are noteworthy because it would seem that Sensing and Perceptive types are those most likely to be interested in primary care specialties. The data from McCaulley's research compares her results with those of Myers for both pre-medical students and medical students. The comparison demonstrates that a scarcity of Sensing/Perceptive types exists in both populations. It would appear that the escalating competitiveness of medical school admissions is filling the applicant pool with more of the students who, because of their psychological type, perform best academically and on tests; i.e. the Intuitive, Judging type. This imbalance can be at least partially rectified by (a) using the interview to assess those qualities which are indicative of each type and by (b) balancing the membership of admissions committees as to psychological

type. The reasoning behind this second proposal is that committee members are subconsciously more likely to recognize as assets those traits and preferences which they themselves possess.

McCaulley, agreeing with the viewpoint of Funkenstein (1970) and Perera (1966), among others, feels that heterogeneity is most desirable in medical student populations since medicine is a highly diversified field.

Demographic Characteristics

SOCIO-ECONOMIC BACKGROUND

In 1965 Rosinski wrote that "although both intellectual and non-intellectual faculties of medical students have been studied, social class has been neglected." Indeed, there is a surprising lack of data on the subject throughout the past twenty years. However, that which is available indicates that the social classes of American society have been disproportionately represented in medical student populations.

In Rosinski's research, a representative sample of American medical schools was used. The students of four "types" of medical schools were examined, with their social class being attributed to father's education and occupation. It was found that "in all the schools a surprisingly small percentage of students came from the two lowest social classes and yet more than 50 percent of the total U.S. population are represented by these categories. The converse is true for the upper social class; 34 percent of the students came from this class and yet this class constitutes only 3 percent of the total U.S. population." It was also noted that, of the four representative schools, the one with the lowest tuition had the highest percentage of students from the two lower social classes.

Fein and Weber (1971) reporting national data for 1959, 1963 and 1967 indicate that this imbalance in the representation of social classes has changed little over the years. Drawing on data collected by NIH and AAMC in 1967-68, they report that "though only 34 percent of all American families reported incomes over $10,000 in 1967, 63 percent of all medical students reported that they came from families with income over $10,000. Conversely, though 25 percent of all American families earned less than $5,000, only 9 percent of all medical students came from such families" (p. 102).

Moreover, the education and occupation of the fathers of medical students place them in the upper social classes. For example, the percentage of students with physician fathers has been disproportionately large over the past twenty years (Johnson and Hutchins, 1966). It should be noted, however, that these students have been fairly proportional to

their representation in the applicant pool (Supplementary Tables to Dubé and Johnson, 1974). Similar data collected in the 1970's (Johnson, 1975b) show a continuation of these patterns.

Fein and Weber (1971) pointed out that "even though it is clear that, on the average, medical students come from the highest socio-economic groups, there is considerable variation in the socio-economic status of students attending the various medical schools" (p. 103). This coincides with the findings in Rosinski's study (1965) and lends further support to the causal relationship between tuition level and socio-economic background of students. Supplementary data from AAMC's last three applicant studies (Dubé and Johnson, 1974, 1975a, 1975b) indicate that, in recent years at least, there has not been much difference in the percent of accepted versus rejected students in each income level. This is in spite of the fact that MCAT scores and GPA's increase somewhat from one income bracket to the next. No similar data are available for previous years as of this writing.

GEOGRAPHIC ORIGINS

In recent years attention has increasingly been drawn to the need for more physicians in rural areas (Colwill, 1973; Colwill, 1976; O'Brien and Bagby, 1975; Applied Management Sciences, 1976; Aaron, 1976a). The yearly education issues of J.A.M.A. have also pointed to a continuing geographic maldistribution of medical students and physicians over the past twenty years. However, there are little concrete data on the rural/urban distribution of students.

Since the association has been drawn numerous times (see references above) between a medical student's geographic background and his/her eventual practice location, much attention has been directed towards increasing the number of applicants from rural backgrounds. Information collected by the AAMC (1975b) indicate that many, if not most, medical schools are attempting to correct geographic imbalances in their student bodies.

Colwill (1976) reports on efforts of the University of Missouri-Columbia School of Medicine to "reflect the overall demographic patterns of the state in the medical class, thus, providing a somewhat higher percentage of students with rural backgrounds than might otherwise occur."

Mattson, Stehr and Will (1973) reported on a successful program in Illinois which seeks out capable students from doctor-needy rural areas and recommends them to the University of Illinois medical school. In return for either a recommendation (which guarantees admission), or financial assistance (up to $6,000 over a four-year period), or both, the applicants agree to practice in a needy community. (See Chapter IV for a more complete discussion of this program.)

There is some question, however, as to the fruitfulness of increasing the number of applicants from small communities as a sole solution to geographic maldistribution. Schwartz and Cantwell (1976), reporting on data from the most recent Weiskotten Survey, state that "survey respondents, like the population as a whole, who came from the smallest towns and those of 25,000 and less, have migrated to cities of 25,000 or more" (p. 535). For example, of a sample of 4,996 physicians, only 16.2 percent of those who were reared in communities of less than 10,000 are now practicing in that size community; 44.3 percent are practicing in communities of 100,000 or more; while the remaining 39.6 percent are working in communities of 10,000 to 99,999.

A variety of other programs have been, or are being developed in many schools (AAMC, 1975b), which focus on a wider range of solutions than simply the recruitment of rural applicants. These endeavors may ensure a regional distribution of applicants and future physicians more responsive to the country's need for medical services.

Rolph and Williams (1976) give a striking demonstration of the effect an applicant's state of residence can have on his admission to medical school. Citing J.A.M.A. data on U.S. medical schools, they found an apparent increase in recent years in the preference given by both public and private medical schools to applicants from their home state (see Table 6.4). Possible causes of this widespread phenomenon are cited as ranging from state political considerations, to physician shortage concerns, to changes in the patterns of applicants.

However, this study also found that "tabulating the acceptance success by applicant's state of residence alone is not enough because there may be other differences between applicants from the various states which would lead to spurious conclusions. For example, about 37% of the nonminority applicants from New York and North Dakota were admitted to some medical school. But the applicants from North Dakota all came from undergraduate colleges at the low end of the selectivity scale while applicants from New York mostly came from more selective undergraduate colleges" (Rolph and Williams, 1976, pp. 9-10). Controlling for other differences in applicants' backgrounds, they found that there was "a substantial advantage in being from North Dakota rather than New York when applying for medical school admissions" (p. 10).

The effect of state residence, according to Rolph and Williams, varies greatly by state. No statistically significant relationship was found between the state of residence and the ratio of either public or private medical school places per 1,000 population. "This suggests that differences in policies across schools is much more important in explaining state-to-state differences in admissions odds than the number of medical school places located in the state" (p. 32).

TABLE 6.4

NUMBER AND PERCENT OF STATE RESIDENTS ENROLLED IN FIRST-YEAR CLASS BY PUBLIC AND PRIVATE MEDICAL SCHOOLS, 1969-1970 Through 1974-1975

Year	Public Schools		Private Schools		All Schools	
	Number	Percent	Number	Percent	Number	Percent
1969-1970	4,935	86	1,984	43	6,919	66
1970-1971	5,466	87	2,286	45	7,752	68
1971-1972	6,011	88	2,595	47	8,606	70
1972-1973	6,676	89	2,997	50	9,673	72
1973-1974	7,082	90	3,080	51	10,162	73
1974-1975*	7,778	93	3,143	51	10,921	76

* Harvard, George Washington, and Case Western did not provide this information.

Source: J.A.M.A., December 29, 1975, p. 1339.

SEX

Up until the 1970's, the role of physician was, for the most part, considered a masculine domain. From 1955-1965, only modest increases were seen in the numbers of female applicants and acceptees (Table 6.5). In 1966, AAMC reported that "women are manifesting an increasing interest in medicine by increasing their numbers as both medical school applicants and as medical school graduates. With the growing shortages of medical personnel and the increasing roles in medicine compatible with the accepted roles imposed on women by our culture, even greater numbers of women may in the future consider medicine as a career" (AAMC, Div. of Operational Studies, 1966 , p. 164). Indeed they did. Changes in societal attitudes towards appropriate roles for women and changes in the perceptions of women themselves regarding career opportunities brought on rather dramatic increases in female applicants and enrollees (Table 6.5 adapted from Dubé, 1976b). Dubé also attributes part of these changes to the passage of federal legislation prohibiting sex discrimination in any federally funded education program.

As seen in Table 6.6, the enrollment of women from all minority groups increased by 1,954 (115 percent) from 1971-72 to 1975-76 (ibid., p. 693). These gains are also impressive when analyzed for individual ethnic/racial minority groups (Table 6.6).

The ratio of accepted to rejected female applicants has been roughly equal to that of males over the past twenty years. Thus, the small number of enrolled women might possibly be more a reflection of their small numbers in the applicant pool (caused by a multitude of factors not directly related in any way to the admissions process) than a reflection of discriminatory policies of admissions committees.

Since the literature does not contain any mention of programs to recruit more women, the recent upsurge in female applicants appears to have been caused by general societal trends (Carter et al., 1974) rather than direct intervention in the admissions process. For whatever reasons though, it appears likely that the representation of women in medical schools will continue to increase (Dubé, 1976b).

RACIAL/ETHNIC IDENTITY

Since the late 1960's, much attention has been focused on increasing the number of minority applicants and enrollees. Unlike the situation for female applicants, discrimination against minorities unfortunately did exist within the admissions process for many decades. In 1955 a number of schools still would not admit Afro-American applicants (Raup and Williams, 1964). As for other minority groups (American Indians,

TABLE 6.5

Women Applicants To U.S. Medical Schools, For Selected Years From 1955-56 Through 1975-76

Year	Number of Medical Schools	Total Number of Applicants	Women Applicants		Total Number of Acceptees	Women Acceptees		
			No.	Percent		Number	Percent of Women Applicants	Percent of All Acceptees
1955-56	82	14,937	1,002	6.7	7,969	504	50.3	6.3
1960-61	86	14,397	1,044	7.2	8,560	600	57.5	7.0
1965-66	88	18,703	1,676	9.0	9,012	799	47.7	8.9
1970-71	103	24,987	2,734	10.9	11,500	1,297	47.4	11.3
1975-76*	114	42,238	9,563	22.6	15,176	3,603	37.7	23.7

Source: Dubé, 1976b, p. 691.

*These are updates of the preliminary figures reported by Dubé.

TABLE 6.6

Comparison of Minority Women First-Year Enrollments In U.S. Medical Schools, 1971-72 Versus 1975-76

	1971-72			1975-76		
		Women			Women	
	Total	No.	Percent	Total	No.	Percent
All Students	12,361	1,693	13.7	15,295	3,647	23.8
Selected U.S. Minorities						
Black American	882	200	22.7	1,036	376	36.3
American Indian	23	8	34.8	60	21	35.0
Mexican American	148	10	6.8	224	46	20.6
Puerto Rican (Mainland)	40	6	15.0	71	24	33.8
Subtotal	1,063	224	21.1	1,391	467	33.6
Other U.S. Minorities						
American Oriental	217	42	19.4	282	86	30.5
Other*	*	*	*	73	23	31.5
Subtotal	217	42	19.4	355	109	30.7
All U.S. Minorities	1,280	266	20.8	1,746	576	33.0

*No data collected for 1971-72.
Source: Dubé, 1976b, p. 692.

Mexican Americans and Mainland Puerto Ricans), no data were uncovered for the period prior to 1968 which would reveal how many were applying to medical school or how many were accepted (Manly, 1971a).

Before the 1970's, the majority of black medical students were enrolled at Howard and Meharry (Raup and Williams, 1964). In 1968-69, these two institutions enrolled about 63 percent of all black medical students in the U.S. By 1971-72 the proportion was down to 27 percent (AMA, 1972) and in 1974-75 it had further dropped to 20 percent (derived from MSAR, 1975). This trend does not, of course, reflect a declining number of black medical students at Howard and Meharry, but rather an increase in the number of black students enrolled at predominantly white schools.

In 1955-56, only 2.6 percent (Raup and Williams, 1964) of all medical school enrollments were composed of black students. Little change had occurred by 1969-71 when the proportion was at 2.8 percent (Nelson et al., 1970). The 1975-76 enrollment figures show an increase, with 6.2 percent of the medical student population self-identified as Afro-American. (In order to be consistent, enrollment figures have been used here since application figures by race were not available for 1955-56.) Table 6.7 demonstrates the racial/ethnic breakdown of the 1975-76 applicants and acceptees. Unfortunately, comparable figures do not exist for this extensive a delineation in earlier periods.

Much has been written over the past nine years about the need to increase minority representation in medical schools, and about efforts made to do so (AAMC yearly Applicant Studies; Hutchins et al., 1967; Elliott, 1969a; Jarecky, 1969; Johnson, 1969; Nelson et al., 1970; Gardner et al., 1972; Blue Spruce, 1972; Buxbaum, 1972; Ramsay, 1973; Student National Medical Association, 1974; DHEW, 1974; Thompson, 1974; Carter et al., 1974; D'Costa et al., 1974; D'Costa and Prieto, 1974; Johnson et al., 1975; Pearce and Gorelick, 1975; Gaines, 1975; Henig, 1976b. These reports concern efforts by individual schools as well as programs proposed for national implementation. Even a cursory examination of this literature indicates the complexity of the situation and the problems involved. Many, if not most, of the problems appear prior to admissions. For example, as Henig (1976b) reports: "Some see the major problem in the 'minority education business' not in admitting minority students but in encouraging them to apply in the first place" (p. 29). Factors which discourage minority students from applying include lack of role models, inferior educational backgrounds, lack of financial resources, and sometimes, the misinformation that medical school admissions is still racially discriminatory.

This last factor (misinformation concerning discrimination) is especially erroneous judging from studies such as that of Carter et al. (1974). They found that of the nine schools in their sample, minority

TABLE 6.7

1975-76 Applicants By Racial/Ethnic Self Description

	Accepted		Non-Accepted		Total	
	#	%	#	%	#	%
Total	15,365	100.00	26,938	100.00	42,308	100.00
Black/Afro-American	945	6.15	1,343	4.99	2,288	5.41
American Indian	57	0.37	75	0.28	132	0.31
White/Caucasian	12,985	84.51	21,883	81.23	34,868	82.42
Mexican American	220	1.43	207	0.77	427	1.01
Oriental/Asian-American	387	2.52	833	3.09	1,220	2.88
Puerto Rican (Mainland)	86	0.56	116	0.43	202	0.48
Puerto Rican (Commonwealth)	104	0.68	183	0.68	287	0.68
Cuban	60	0.39	129	0.48	189	0.45
Other	265	1.72	893	3.32	1,158	2.74
No Response	256	1.67	1,276	4.74	1,532	3.62

Source: AAMC, Division of Student Studies, 1976.

applicants received strong preference for the classes entering in 1972. Reverse discrimination suits in recent years (O'Neil, 1976) have strongly discouraged preferential admissions for minorities. However, as explained earlier, the selection criteria used by admissions committees are usually broad enough to allow for differences in the backgrounds of applicants. And, as Sedlacek (1974) pointed out, the use of non-traditional criteria does not imply a lowering of standards. Therefore, while minority applicants may not be given preferential treatment, they are no longer faced with discrimination in the admissions process.

AGE

The age of accepted and rejected applicants has varied little in the past twenty years. The average age of accepted applicants has remained between 20-25, with the heaviest concentration in the 21-23 range (Medical School Admissions Requirements, 1955-56, 1965-66, 1975-76). Two factors have strongly discouraged medical schools from accepting older applicants: 1) the dropout rate of applicants increases with age (Johnson and Hutchins, 1966); and 2) the long years of training involved in becoming a physician limit the number of years "a prospective student can be expected to apply the knowledge and training acquired" (Dubé, 1976a, p. 3).

While the preponderance of accepted applicants are between 20-25 years old, the relatively small number of applicants between the ages of 17-20 have the highest acceptance rates (Figure 6.1). Minority and women applicants and enrollees tend to be somewhat older as a group than their white male counterparts. Table 6.8 presents data on the age, race and sex of applicants to the 1972 entering class.

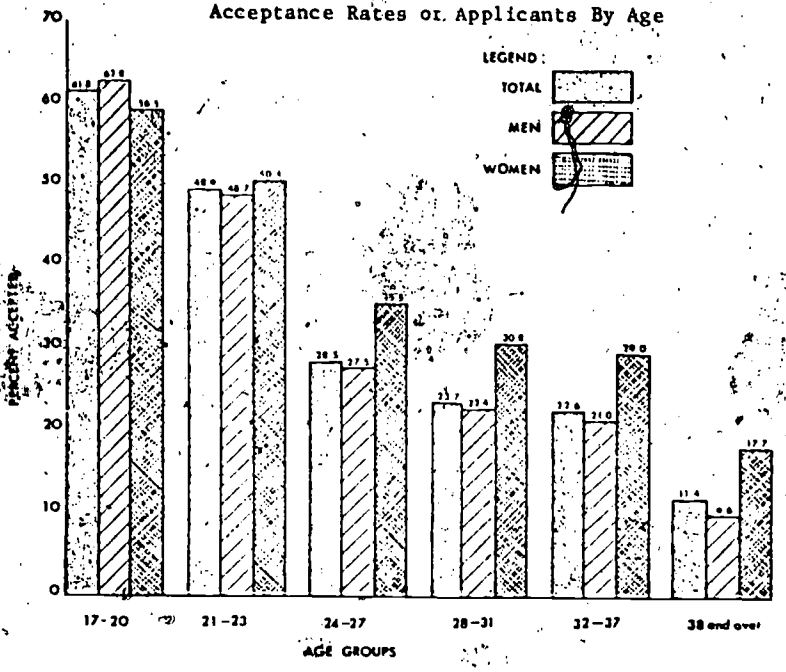
Nonmatriculating and Unaccepted Students

The information available on nonmatriculating students is limited to an occasional reference to their numbers in the AAMC annual applicant studies. The percentage of nonmatriculating students remained at approximately 5 percent until the 1970's, when it gradually dropped to an annual rate of about 3% (Johnson and Dubé, 1975).

All of the information discovered in the literature on the changes in characteristics of unaccepted applicants has been cited in previous sections of this chapter. However, as Green (1970) points out, little research has been conducted in this area over the years. Most studies focus on the successful rather than the unsuccessful applicant.

FIGURE 6.1

Acceptance Rates of Applicants By Age



Source: Dube, W. F., Johnson, D. G., and Nelson, B. C. Study of U.S. Medical School Applicants, 1971-72. Journal of Medical Education. 48:395-420, May, 1973.

TABLE 6.8

MEAN AGE BY RACE, SEX, AND MATRICULATION SUCCESS OF APPLICANTS TO THE 1972 ENTERING MEDICAL SCHOOL CLASS

Matriculation Status	Caucasians (23,196)††	Black Americans (1,786)	American Indians (121)	Mexican Americans (229)	Puerto Ricans* (341)
Male	23.5	25.2	24.6	24.4	23.0
Nonmatriculants	24.0	25.8	24.5	24.9	23.5
Matriculants	22.8	24.4	25.0	24.0	22.1
Female	23.7	24.0	24.8	24.3	22.0
Nonmatriculants	24.2	24.6	24.7	25.9	21.7
Matriculants	23.1	23.4	24.9	22.4	22.9
All applicants	23.6	24.9	24.7	24.4	22.7

* Includes both mainland and island Puerto Ricans

†† Figures in parentheses are the total number of individuals about whom all of the above data were available at the time study was conducted

Source: Johnson, D.G., Smith, V.C., Jr. and Tarnoff, S.L. Recruitment and Progress of Minority Medical School Entrants, 1970-1972. Journal of Medical Education. 50:713-755, July, 1975.

Some literature does exist on the fate of rejected applicants. These studies explore such areas as the percentage of rejected applicants who reapply; how many times they reapply; how successful they are upon reapplication; what types of careers they choose as an alternative to medicine; and what type of counseling could be given to them (Hutchins and Morris, 1963; Green, 1970; Hamberg and Schwarz, 1972; Becker et al., 1973; Levine et al., 1974; AAMC, 1976c). What these studies of rejected applicants show is that, in spite of having the door to a medical career closed to them, a large proportion of them have been sufficiently interested in a career in health to again attempt to open that door by reapplying to a U.S. school or by studying medicine abroad. Or they may attempt to open other doors by applying for study in other health professions. Certainly such persons are an asset for an integrated system of health care which can effectively utilize workers at all levels of professional training and in all health fields.

EPILOGUE

Who becomes a physician and how well that person practices medicine by no means depends solely on modifications of admissions procedures and improved personality assessment. For if only admission procedures and standards are modified without concomitant changes in medical education and the health care system in which students are eventually called upon to practice, one can count on little of positive consequence resulting from even major modifications of the selection system. What is needed is an articulated strategy affecting the selection of future physicians, the design and maintenance of those instructional situations in which students are educated and socialized into the medical profession, and the character of that health care delivery system into which students are eventually thrust to practice what they have been preached.

(From Shulman and Elstein in Haley, D'Costa and Schafer, 1971, p. 207.)

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