

The Intellectual Caliber of Medical Students

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During the past decade, increasing signals of alarm have been sounded by medical educators and the public press about an alleged decline in the intellectual caliber of the entering medical student. In a summary of the then recent trends, the Datagram for July 1959 (1) asked what's happening to our medical school applicants and proceeded with a four-part reply to this question:

... the total number of medical school applicants seems to be decreasing in the face of increasing enrollments and increasing graduates from college... the percentage of students entering medical schools with an average grade of "A" has been decreasing... the percentage of students withdrawing during their freshman year in medical schools increased from 5.5 per cent in 1954-55 to 7.8 per cent in 1957-58... the number of students withdrawing, both in poor and in good standing, increased steadily since 1954.

In a careful and detailed analysis of some of these same trends, comparing the 1959-60 applicants with those of a decade earlier, Hutchins and Gee (2), while not minimizing the need for continued close scrutiny of such trends, concluded the following:

This 1959-60 applicant study notes

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a small decrement in the number of applicants to medical school for the third successive year. The actual size of this decrement is not particularly disturbing in view of the wide fluctuations in applicant activity over the past 13 years and in view of the continued high caliber of the accepted applicant group.

The study reported here was begun in 1963 to provide answers to allegations of a decline in the intellectual caliber of medical students. In that year the first author was invited to Chicago to address the Annual Meeting of the Association of American Medical Colleges on this subject. The present paper constitutes, in the main, his address. That the conclusions reached in 1963 have not changed and are today even clearer will be seen in the new data for 1963-71 which have been added by the second author.

In order to assess the intellectual caliber of current medical students, the writers have used a variety of criteria of intelligence which they felt, on purely subjective grounds, most readers might be expected to agree are useful yardsticks for assessing intellectual caliber. The four criteria settled on were intelligence quotient—the single best overall measure of intelligence—Medical College Admission Test (MCAT) scores, college grades, and medical school attrition rates. The first two of these four criteria are indices of a student's potential performance, whereas the last two criteria are measures of his actual performance (3, 4).

TABLE I
IQ SCORES OF MEDICAL STUDENTS, 1946-1967

Author	Year	N	IQ Measure	Average IQ
Waggoner and Zeigler (6)*	1946	136	Wechsler (W-B)	126
Stewart (7)	1947	124	AGCT	127
Harrower (8)	1955	160	Wechsler (W-B)	122
Holt and Luborsky (9)	1958	238	Wechsler (W-B)	128
Wolpin and Garfield (10)	1960	491	ACE	130
Johnson (11)	1960	330	Otis	127
Schwartzman, et al. (12)	1961	62	Wechsler (WAIS)	126
Jarecky and Johnson (13)	1962	319	Otis	127
Kole and Matarazzo (14)	1965	80	Wechsler (WAIS)	126
Sedlacek (15)	1967	7,463	ACE	131

* Figures in parentheses refer to references.

IQ

There are several well known tests of intelligence quotient. Probably the best of these for adults is the one developed by Wechsler (3, 4), although a well known forerunner of it for both children and adults was the Stanford-Binet. Interestingly, despite the continued usage of the expression "intelligence quotient," this index, or score, has not been computed as a ratio for several decades. Rather, like the MCAT or "College Board" Scholastic Aptitude Test scores, which have a mean of 500 and a standard deviation of 100, tests of IQ have a mean of 100 and a standard deviation of approximately 15. The IQ for the earned "raw score" performance of any given individual is obtained from tables which are available for different age groups, thereby eliminating the need to divide each individual's "test age" by his "actual age" to arrive at his IQ. Since the distribution of IQ, like that of the MCAT, is a normal one, the IQ of any given individual can be interpreted in terms of his position in his total age group—exactly as is done with the MCAT. It is not unusual, therefore, to find psychologists reporting performance on an IQ test not in terms of an IQ but in terms of the individual's rank (percentile) relative to others in his age group. It is clear that an IQ score

has at least two important extra-test meanings. On the average it correlates with the highest educational level one can be expected to attain (3, 4), and it can serve as an index of the probability, again on the average, that an individual will be in a particular occupation in later life, as shown by Thorndike and Hagen (5). Thus, for the purposes of the present study, IQ score would appear to be a meaningful yardstick with which to measure the intellectual caliber of different generations of medical students.

Fortunately, a number of investigators have reported IQ scores on medical students during the past 25 years (Table 1). (Studies by Wolfe [16] and Gee [17] were omitted from the table because they did not report the number of medical students involved.) These investigations were carried out with several different measures of IQ on students in a variety of public and private medical college settings (most of those listed) or in military settings (7) and on physicians in their residencies (9). The IQ measures shown in Table 1 are the Wechsler Bellevue (W-B), Army General Classification Test (AGCT), American Council on Education Test (ACE), Otis Mental Ability Test, and the Wechsler Adult Intelligence Scale (WAIS). In view of the heterogeneity in the samples of medical

students represented in the table, the authors believe the table to represent a fair approximation of a random sample of the total medical student pool from 1946 to 1967.

The results in Table I, which are strikingly uniform, clearly permit these conclusions: (a) the IQ level of the average medical student is approximately 125 (placing him in the top 5 percent of all persons in our society); and (b) individual studies conducted in various parts of the country, and on different groups of medical students, show no change in this high level of intellectual capacity during the years covered by these investigations (that is, the medical student of today is clearly a facsimile of his 1946 counterpart on this very reliable and valid measure of intellectual caliber).

One can ask how the data on medical students in Table I compare with similar data on the intellectual caliber of other occupational and student groups. In an important study Gee (17) has compared the average medical student with the average Ph.D. student and the average college student. Her data, and the important discussion of it which she provides, left the present authors with these extrapolated conclusions: (a) for all practical purposes the average medical student (WAIS IQ of 125) and average Ph.D. student (WAIS IQ of 125) are of equal ability levels (top 5 percent of adult population), and (b) both groups are superior to the average college student (WAIS IQ of 115, top 15 percent of adult population). There is additional evidence, as in the study by Harmon (18) and the studies reviewed by Matarazzo (3), to suggest that the average Ph.D. in this country, if examined by WAIS, would have an IQ of approximately 125. Also, Wechsler (4) has published data which indicate that the aver-

age engineer, accountant, and business executive score at this same high level.

It is important to emphasize that these quoted IQ scores, and those shown in Table I, are averages and that individual students in each of these professional and scientific groups will be found considerably above and below the mean of their group (3). In one study of medical students (14) reviewed in Table I, the IQ scores at either end of the normal curve represented a range from the top 23 percent of the total adult population (IQ of 111) to the top fraction of one percent (IQ of 149) of this population, and Gee (17) provides data to suggest that in at least one medical school in this country the bottom of the IQ range is considerably below the top 23 percent. However, in these two studies the mean IQ also was similar to that of the top 5 percent of the total adult population.

Since 1948 the first author has personally examined, by the Wechsler tests and for a variety of nonacademic as well as academic reasons, a number of students at four medical schools (Northwestern, Washington at St. Louis, Harvard, and Oregon). Despite the possible limitation in these samples, his experience clearly supports the data in Table I inasmuch as: (a) little difference in the WAIS IQ levels of these students (all approximately 125) has been found, and (b) no change has been discerned in these IQ scores since 1948. Interestingly, since in this same period he has also examined individually dozens of practicing physicians (ranging in age from 25 to approximately 65) and has found (subjectively and without systematic study of this point) little change from a mean Wechsler IQ of 125, he would speculate that the IQ level of the average physician graduated in the 1920s and 1930s is little different from those shown in Table I. This is

not difficult to understand. The study of medicine requires a number of hurdles (high school biology, chemistry, mathematics, and physics; a successful completion of a premedical college major, with all its difficulties and resulting self-selection; and, finally, further screening by a medical school admissions committee using such criteria as college grades and MCAT scores). Thus, a medical student, like the successful Ph.D. student, in order to pass through these various stages of sifting, must be superior in intellectual capacity even before being permitted the opportunity to show whether or not he has the admittedly important nonintellective qualities (such as motivation, character, integrity, and dedication) required to demonstrate his ability and thus to graduate from medical school.

One further point may be of interest to medical educators. The best evidence suggests that, because of the restricted range of IQ involved, if a student can graduate from medical school at all (that is, if he is not a scholastic dropout), class rank in medical school seems to bear no relation to IQ. Several times the first author has measured the Wechsler IQ of the top 10 students in a class of 80-100 students and compared this with the IQ of the 10 bottom men in that same class. The results are always delightfully surprising; the IQs of both the top and bottom 10 are about 126. If there is an occasional difference of an IQ point or two, it is not significant statistically. Clearly, for those students who graduate, while nonintellective measures appear to play a role in medical school grades, as do also the (unreliable) faculty grading systems, IQ seems to play little or no role once they have been admitted.

MCAT

Although it is described by many as a test of aptitude or achievement, the present writers always have considered the MCAT an IQ test for a high-ability group. In two unpublished studies at Oregon, the MCAT has been found to correlate with the WAIS Full Scale IQ about .60 to .75, even in the restricted range of talent represented by a sample of medical students. The reason for this is not difficult to understand. It is simply that the MCAT contains two subtests which are found in almost all tests of IQ—a measure of verbal ability (VA) and a measure of quantitative ability (QA). Science (Sci.) and General Information (GI), the two remaining parts of the four-part MCAT, also are similar to the subparts of tests often called measures of intelligence. As a matter of fact, the general information items could, with ease, have been added by Wechsler to the upper limit of his "Information" subtest had he planned to extend his test from one for the general population to one for a highly select sample such as medical students.

Thus, MCAT scores of current and earlier medical student groups provide us with a second criterion for the assessment of changes over the years, if any, in the intellectual caliber of medical students.

Datagrams reporting MCAT scores published annually by the Association of American Medical Colleges supplied data beginning in 1952-53 and the applicant study for 1970-71 (19) provided similar data beginning in 1961-62; this information is presented in Table 2. In interpreting this table, it is important to understand that MCAT scores from one year to the next are directly comparable; that is, in scoring the MCATs

TABLE 2
MEAN MCAT SCORES OF ACCEPTED APPLICANTS FROM 1952-53 TO 1970-71

Year	Accepted Applicants				Number Taking MCAT
	VA	QA	GI*	Sci.	
1952-53	522	526	519	525	7,346
1953-54	519	525	524	530	7,426
1954-55	517	521	530	533	7,527
1955-56	524	528	527	522	7,688
1956-57	525	525	526	519	8,012
1957-58	528	517	527	516	8,223
1958-59	527	532	520	523	8,301
1959-60	529	527	527	527	8,449
1960-61	527	533	527	533	8,500
1961-62	533	538	522	537	8,633
1962-63	544	537	541	545	8,920
1963-64	537	552	549	545	9,021
1964-65	540	567	561	556	9,015
1965-66	541	583	565	549	8,983
1966-67	549	584	566	550	9,109
1967-68	554	596	566	565	9,676
1968-69	556	600	570	577	10,010
1969-70	562	603	569	577	10,493
1970-71	559	606	560	558	11,434

* Prior to May 1962, this subtest was designated Understanding Modern Society.

taken each year by the new applicants, the mean score of the new group by the use of established statistical procedures is made equivalent to that of the original 1951 standardization group. Thus, all scores in Table 2 are based on the same 1951 mean of 500.

If one uses, as a crude basis for comparison, the University of Oregon Medical School MCAT and WAIS scores and Gee's data conversion (17) which indicate that an MCAT score of 515 to 535 is roughly equivalent to a Wechsler IQ of 125 and an MCAT score of 575 is roughly equal to a Wechsler IQ of 128, from Table 2 one can derive the year-to-year mean IQ of medical students in all American schools of medicine in that year. (In contrast Table 1 contains only IQ scores of small, selected samples of medical students.)

However, in interpreting the year-to-year fluctuations shown in the table,

one should remember that the standard error of measurement in the MCAT subtests is approximately 35; that is, allowing for a slight unreliability of measurement, for an individual whose obtained MCAT score is 535, the chances are 2 to 1 that his true score (if this could be assessed) on the MCAT would fall somewhere between 500 and 570 (that is, plus or minus one standard error of his obtained score). Furthermore, the chances are approximately 96 out of 100, or 24 to 1, that if the MCAT were a "perfect" measuring instrument for this same person with an obtained score of 535, his true score would fall between 475 and 605 (that is, plus or minus two standard errors of his obtained score).

Keeping in mind the fact that the slight fluctuations in scores from one year to the next reflect the unreliability of measurement as well as differences in the pools of accepted medical school

applicants, the data in Table 2 reveal a slight but steady upward trend for scores on all four MCAT subtests over the years included in this report and that a transformation to comparable intellectual measures would permit the statement that the intellectual caliber of American medical students has shown a slight, albeit probably statistically not significant, increase from the base year of 1952.

College Grades

Standards of grading vary considerably from one college to the next. Nevertheless, the American Medical Association annually surveys each medical school and obtains from each registrar, among other things, the college grade-point average of each first-year medical student despite the fact that this requires converting to a common measure grades of students from various undergraduate colleges using such disparate grading systems as percentage scores, numerical scores, letter scores, and, the most difficult of all, the rank in graduating class. In addition, some medical school registrars and admissions committees apply weights to college grades from different schools in order to equate for assumed inequalities in their grading systems. These grade-point averages are published in the *Journal of the American Medical Association* yearly and, if interpreted wisely in light of the problems discussed above, can provide a third, although very crude, index of the intellectual caliber of the entering medical students since 1952-53.

Some writers have used the college grade-point averages of entering students in the years following World War II as a baseline for comparing the intellectual caliber of current medical students. However, both the staff of the AMA (20) which compiles these grade-point aver-

TABLE 3
COMPARATIVE ANALYSIS OF COLLEGE GRADE
RECORDS OF FIRST-YEAR MEDICAL
STUDENTS (IN PERCENT) 1952-1969*

Year Entering Medical School	Grade		
	A	B	C
1952	18.0	67.5	14.5
1953	21.1	68.9	10.0
1954	16.8	69.0	14.2
1955	15.8	70.6	13.6
1956	16.1	69.9	14.0
1957	17.7	66.0	16.3
1958	16.0	69.7	14.3
1959	15.1	70.0	14.9
1960	13.4	71.0	15.6
1961	12.2	70.4	17.4
1962	12.5	70.9	16.6
1963	12.3	76.1	11.6
1964	13.8	75.8	10.4
1965	12.7	76.7	10.6
1966	13.6	77.8	8.6
1967	14.1	76.8	9.1
1968	16.8	75.9	7.3
1969	17.9	76.6	5.5

* This table is adopted from one presented by the American Medical Association (20).

ages and Hutchins and Gee (2) of the AAMC staff have pointed out that these postwar years were atypical in that there were in each year several generations of entering medical students whose education had been interrupted by the war. Thus, it is not surprising that 40 percent of the class entering in 1950-51 had "A" averages in college or that 30 percent of the class entering in 1951-52 had similar "A" averages. By 1952-53 the postwar overflow probably was assimilated; therefore, that year can serve as a more useful baseline for evaluating the current classes of medical students. Table 3 provides data on the college grades of all first-year medical students in this country for the years 1952 through 1969.

It would appear from the data given in Table 3 that while the percentage of students entering medical school with a "B" average has slowly increased since 1952-53, the "C" student has recently

begun to represent a smaller portion of his entering class and the proportion of "A" students has been increasing since the beginning of the 1960s, bringing the level back to that of the base year of 1952-53.

However, for the present writers, college grade-point averages are too unreliable to use as a meaningful indication of intellectual caliber. It was because of this and because grading practices varied so much from one college to another that our medical colleges initiated steps in 1930 which led to the development of the MCAT in 1950; it was then and still is a more reliable index of intellectual caliber than college grades. Were this not the case, the considerable yearly cost of the MCAT could not be justified. Table 3 has been included in this discussion only because of the importance given to the college grades of medical school entrants by the news media during the late 1950s and early 1960s.

Attrition Rates

The fourth and final criterion of intellectual caliber which occurred to the present writers was the attrition rates among medical students. In a real sense such measures as IQ, MCAT, and college grades are merely the predictor variables which indicate the probability that a potential medical student will or will not succeed in medical school. Graduation from medical school, or failure to graduate, is the ultimate test of these predictors. Thus, every medical student who graduates represents a success in selection, and every dropout who never graduates represents a failure in this process.

It appears sensible to the present writers to assume that graduating from a medical school is no easier today than it was 10 or 20 years ago. For this reason

attrition rates appear to provide an excellent practical index of the intellectual caliber of medical students in different generations. A weakness in this argument is that medical educators, in grading a class of medical students by the usual process of comparing each student with the others in his class, could thereby overlook the overall mediocrity of one whole class relative to an earlier class. However, the data in Tables 1, 2, and 3 clearly do not suggest such an increase in class mediocrity during the past two decades. Thus, attrition rates during this period would seem to provide a highly useful fourth criterion of intellectual caliber.

In a 1946 study of the 5,873 students then in American medical schools, Mullin (21) found an attrition rate of 11.2 percent among students between the first and second year of medical school. (Two-thirds of these dropouts were for "academic" reasons and one-third for "nonacademic" problems.) This same two-thirds versus one third ratio remained unchanged in 1957, as shown in an AAMC Datagram (1) and in Moore's paper (22). By 1969, however, only 42 percent of students who withdrew from medical school in their first year did so for academic reasons (20).

The data in Table 4 indicate that the national attrition rate steadily increased through 1961 and since then has been, just as steadily, decreasing to a point somewhat below the base year of 1952 for the class which entered in 1966. Of interest are the figures on what students withdraw to do. In the AMA report from which data for the table were obtained (20), it was indicated that there had been a steady increase (from 7.3 percent in 1963-64 to 19.6 percent in 1969-70) in the proportion of withdrawing students who withdrew from medical

TABLE 4
ATTRITION BY YEARS FOR MEDICAL STUDENTS
FAILING TO GRADUATE IN FOUR YEARS*

Entering Year	First-Year Students	Graduates Four Years Later	Percent Not Graduating in Four Years
1952	7,425	6,845	7.8
1953	7,449	6,796	8.8
1954	7,576	6,861	9.4
1955	7,686	6,860	10.7
1956	8,014	7,081	11.6
1957	8,030	6,994	12.9
1958	8,128	7,088	12.8
1959	8,173	7,177	12.2
1960	8,298	7,259	12.5
1961	8,483	7,321	13.7
1962	8,642	7,574	12.4
1963	8,772	7,743	11.7
1964	8,856	7,973	10.0
1965	8,759	8,059	8.0
1966	8,964	8,367	6.7

* This table is adapted from one presented by the American Medical Association (20).

school to pursue another type of advanced study. However, the authors of that report warned, "Most of these students will presumably return to medical school; hence, this should be considered in any reference to the attrition rate." In the absence of confirming data, this statement is of necessity qualified, although the present writers feel that it is warranted.

In order to provide a perspective from which to interpret the current medical student attrition rate of approximately 7 percent (Table 4), it would be useful to examine the attrition rates among students in other fields. For example, of every 100 students who enter American colleges, 40 fail to graduate (23); of every 100 nursing students who enter collegiate schools of nursing in this country, 44 fail to graduate (24); and of every 100 students who enter the accredited American law schools, 43 fail to graduate (25). Viewed in the context of these figures, each of which probably is still current today, the loss of only 7

of every 100 entering medical students should serve as a matter of pride to medical educators. (The loss among dental students is probably about the same as for medical students, as suggested in figures published by Parkin (26).)

This discrepancy in attrition rates for medical school as opposed to other professional programs is a large one and is most probably ascribable to selection procedures. It would appear that the selection process for medical students is by far the most rigorous and takes place for the most part prior to actual entry into a program, whereas the less rigorous selection procedures for other professional disciplines must of necessity continue through the first few years of the programs.

The conclusions that are drawn from Table 4 and from these other data on attrition that have been presented are: (a) attrition rates in all colleges and professional schools should be a continuing concern to all educators; (b) there has been an increase and then a decrease in the average attrition rate among medical students in the past two decades; (c) these attrition rate changes notwithstanding, compared with attrition rates of colleges and other professional schools, medicine is doing a surprisingly good job; and (d) the attrition of even one potential physician is a serious personal and national problem and, therefore, efforts to reduce this attrition to a theoretical figure of zero should be continued.

Relative to the last conclusion, it should be emphasized that, in practice, the current attrition rate of 7 percent can be reduced considerably by the efficient use of psychological and psychiatric personnel (27, 6). At the University of Oregon Medical School, since the establishment of a full-time Department

of Psychiatry in 1957 and a full-time Department of Medical Psychology in 1961, the attrition rate has dropped from above the national average of 7 percent to a very small fraction of this figure. The approach involves: (a) the personal commitment of a psychiatrist (or psychologist, or both) who will devote almost all of his or her faculty time to salvaging an otherwise lost potential physician and (b) the use by this person of a philosophy of psychotherapy and rehabilitation which is oriented toward solving the very real day-to-day practical problems of the student (such as poor study habits, financial problems, marital difficulties, or temporary disillusionment with medicine) and not toward probing so-called unconscious problems. Whether these latter are relevant or not, experience at Oregon indicates that the student who is facing a cessation of his medical studies is not motivated toward this type of self-exploration. Using the former orientation, a psychiatry faculty member was able to demonstrate to the other members of the medical school faculty that practically every student who heretofore had been dropped could have been salvaged and, most importantly, could have been graduated with pride by this same faculty.

Conclusion

The data reviewed here suggest that, contrary to signals of alarm, the intellectual caliber of today's medical student is at least as high as that of his contemporary of 20 years ago, if not slightly higher. The rate of attrition, a figure of concern a decade ago, has diminished to a point comparable with the base year of 1952. Entering students come with better histories of past academic performance. Given a greater appreciation of the talent and commitment of this

group of young people, we can graduate more physicians not only by building more medical schools but also by better husbanding the fine talent now found almost universally in our medical schools.

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