Research Article

Intelligence quotient analysis and its association with academic performance of medical students

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ABSTRACT

Background: Intelligence is the ability to see meaningful relationships between things that includes perceiving, knowing, reasoning and remembering. The study was done to know the duration of preparation, self study hours, academic performance and its association with IQ level of medical students, to state how to shorten the duration of completing MBBS degree.
Methods: A cross sectional study done on 300 medical students using structured questionnaire derived from I Q test.com. Data collection and appropriate statistical test were applied considering p value ≤ 0.05 as significant.
Results: Most of the medical students had near average intelligence (88.3%) , they undergone one to two years preparation for medical entrance exams and devoted much time (>6 hrs) in studies. 10% of the students had higher IQ, spare less time in their self study but were sincere in the classes.
Conclusion: Students with near average IQ work hard in their studies and their academic performance was similar to students with higher IQ. So IQ can`t be made the basis for medical entrance; instead giving weight-age to secondary school results and limiting the number of attempts may shorten the time duration for entry and completion of MBBS degree.

Keywords: Genius, Intelligence, Medical, Performance, Quotient

INTRODUCTION

In India Since independence, universal and affordable health which is central to the planning of the health system**,** [1] has been failing due to lack of qualified health care providers specially doctors and nurses. According to census (2001) there are only 3·8 allopathic doctors, and 2·4 nurses and nurse-midwives per 10 000 people. [2] even now we are not in a position to train the adequate number of doctors. The reason may be of lack of infrastructure or long duration of MBBS course or else.

Though MBBS is five and half (5+1/2) year's course, but it takes nearly 7 to 8 years for a matriculated student to complete the MBBS degree. The reason has been 2 to 3 years preparation for medical entrance, and time expenses due to failures in MBBS semester exams. To find relation between students IQ and time lapsed by them for medical entrance exam preparation and during actual course due to failures, the study has been conducted. The study interrogated about number of attempts by students for medical entrance, their self study hours, and attempts in semester exams. The basic purpose was to analyse whether inclusion of IQ tests in the medical entrance will be able to reduce the years for getting MBBS degree (by selecting students with higher IQ).

Secondly IQ is also of importance to medical students, because they are future physicians and will face complex and novel situations in which a quick, and complex,

decision is warranted, they may be prone to poor problem solving and attention to critical detail, rendering them vulnerable to errors in judgment. The poor problem solving and decision making hampers doctor- patient relationship and patient satisfaction.

Intelligence: Intelligence is the ability to see meaningful relationships between things. It includes perceiving, knowing, reasoning and remembering. There is considerable relationship between a person's degree of intelligence and range of activities, the level of achievement and the depth of understanding possible to him. Terman and Gessel defined intelligence as the capacity to use abstract ideas for solving problems.[3]

Intelligence Quotient: In 1912, the German psychologist William Stern coined the abbreviation "I.Q.," a translation of the German Intelligent-Quotient ("intelligence quotient), proposing that an individual's intelligence level can be measured as a quotient of their estimated "mental age" and their chronological age.[4]

$$\text{Intelligence Quotient} = \frac{\text{Mental Age}}{\text{chronological age}}$$

When the mental age is the same as chronological age, the IQ is 100. The higher the IQ, the more brilliant is the child. 80 per cent of people have an IQ of or near 100.categorization of different cognitive states based on IQ is given in (Table 1).

Table 1: Individual's categorisation in different cognitive states based on their IQ.

Levels of Intelligence	IQ Range
Idiot 0-24	0-24
Imbecile	25-49
Moron	50-69
Border Line	70-79
Low normal	80-89
Normal	90-109
Superior	110-119
Very Superior	120-139
Near Genius	140 and above

IQ Score: The first IQ tests were designed to compare a child's intelligence to what his or her intelligence "should be" as compared to the child's age. If the child was significantly "smarter" than a "normal" child of his or her age, the child was given a higher score, and if the child scored lower than expected for a child of his or her age, the child was given a lower IQ score.[5]

Intelligence tests: Most of the intelligence tests are measures of performance. However, the term performance is customarily applied to tests which call for a minimal understanding and use of language. These tests provide a measure of fundamental psychological process, such as reasoning and seeing relationship, without at the

same time depending upon particular cultural or educational opportunities. The different tests and scales used are[6]**:**

1. Binet-Simon scale[3,7]
2. Reynolds Intellectual Assessment Scales[8] (RIAS)
3. Composite Intelligence Index[9] (CIX)
4. Web based IQ tests[6]**:** Queendom.com's classical intelligence test, Tickle.com's classic IQ test *and* IQTest.com's intelligence test.

We in this study have used IQTest.com's intelligence test. This Intelligence Test contains 38 questions and utilizes 13 intelligence scales: arithmetic, algebraic, rote utilization, logical, visual apprehension, spatial skill, intuition, general knowledge, vocabulary, short term memory, spelling, geometric, and computational speed.

METHODS

This is a cross sectional study done in a government autonomous medical college, in central India from August 2013 to December 2013. Each admission batch for MBBS had 150 medical students and 5 such batches run in the college. Students from middle batches were selected purposefully to avoid recall bias among older batches and newly admitted batch had no exposure of semester exams. All the students from junior final and Second Profs (batch 2012, 2011 and 2010) including students from detained batches were invited for the survey/questionnaire and finally 300 students with completed questionnaire were selected. Pre-tested performa were included for analysis of data, incomplete/partially completed Performa were rejected. The study was a part of teaching programme for undergraduate medical students in research methods initially which was finalised for further research.

Study tool: all the selected students were informed about the purpose of study and verbal consent was taken. A structured questionnaire derived from the I Q test.com with other semi-structured questionnaire about personal profile and study profile was administered to them. First of all questionnaire of personal profile was administered which was to be completed in 10 minutes. After this IQ test questionnaire was administered and time taken by each individual to complete this questionnaire was recorded. The scoring of IQ level is given in (Table 2).

Table 2: Interpretation of IQtest.com score.

Time scoring	Marks score	Intelligence interval	Cognitive designation
>30 min –5marks	Each question carries 3 marks. Maximum marks	40-54	Severely challenged
25-30 min-10marks		55-69	Challenged
20-		70-84	Below

25min-15 marks	3x38=114		average
15-20min-20 marks		85-114	Average
11-13min.-45marks		115-129	Above average
<11min-60marks-		130-144	Gifted
		145-159	Genius
Maximum total score: 60+114=174		160-175	Extraordinary genius

The data was collected in excel spread sheets, and analysed using statistical software (SPSS version 20) and online statistical test calculators. Appropriate tests of significance were applied at suitable places and p value ≤ 0.05 was considered significant.

RESULTS

The study was done on 300 medical students 140 boys and 160 girls. The mean age of the subjects was 22.67 years.

On application of IQ test.com 5 (1.7%) subjects had below average IQ, 150 (50%) subjects had average IQ and only 30 (10%) had above average/genius/ extraordinary IQ. The academic performance of students with average IQ was highest and that of below average IQ was poorest among all. The academic performance had no positive or negative correlation with IQ level of students (Table 3). The IQ level of male and female students was similar without any significant difference (Chi-square = 1.74, degrees of freedom = 5 probability = 0.884, P>0.05).

All the Students with higher IQ (extra ordinary, genius and gifted) were from well to do families i.e. upper and upper middle class.[10] 35(30%) students with above average IQ, 64 (43%) students with average IQ and 4 (80%) students with below average IQ belong to lower middle and upper lower classes families. Only9 (3%) students belong to lower class family, they had above average IQ.

Only 28 (9.3%) students were able to crack medical entrance exam in their first attempt (fresher) and got admission in MBBS course. Among these 26 (92.8%) students had above average/genius/gifted/extraordinary IQ and only 02 (7.2%) students had average IQ. Most of the medical students (169, 56.3%) taken one year drop for medical entrance preparation. These students had average IQ (78) above average IQ (85). 33 (11%) students needed more than 2 years for medical entrance exam preparation, 30 (90.9%) of them had average and below average IQ (Table 4).

All the students with higher IQ (gifted/genius/ extraordinary) spent less than six hours for study and rest of the time in sports and extra-curricular activities. Among 115 students with above average IQ, 37 (32.2%) spent less than six hours and 78(67.8%) more than six hours for their studies per day. Among students with average IQ 54 (36%) spent less than 6 hrs and 96 (64%) more than six hrs for their study (Table 5).

MBBS students had daily classes of six hrs for theory and clinical work. Students were keen to attend their classes, 276 (92%) were regular, and others were irregular/occasional attendees. All the students with higher IQ (gifted / genius/extraordinary) were regular in their classes. The irregular/occasional attendees had above average/ average or below average IQ (Table 6).

Table 3: IQ level of medical students and their academic performance.

S. No.	IQ category	Males*	Females*	Total (N)	Percent	Avg. Percentage in previous prof
1.	Extraordinary Genius	2	3	5	1.7	61
2.	Genius	6	4	10	3.4	58
3	Gifted	7	8	15	5	60.3
4	Above average	50	65	115	38.3	59.5
5	Average	72	78	150	50	64.15
6.	Below average	3	2	5	1.7	57
	Total	140	160	300	100	59.99

*Chi-square = 1.74, degrees of freedom = 5 probability = 0.884, P>0.05

Table 4: IQ level compared to number of years of preparation for entrance examination for medical course.

S. No.	IQ category	Fresher	1 year drop	2 years drop	More than 2 years	Total N
1.	Extraordinary Genius	04	01	0	0	5
2.	Genius	6	2	2	0	10
3	Gifted	12	1	1	1	15
4	Above average	04	85	24	2	115
5	Average	02	78	42	28	150
6.	Below average	-	2	1	2	5
	Total	28 (9.3%)	169 (56.3%)	70 (23.3%)	33 (11%)	300 (100%)

Table 5: Number of self study hours by students on a daily basis.

S.no.	IQ category	0-2 hrs	2-4hrs	4-6hrs	> 6hrs	Total
1	Extraordinary Genius	0	2	3	0	5
2	Genius	2	4	4	0	10
3	Gifted	7	8	0	0	15
4	Above average	1	14	22	78	115
5	Average	0	10	44	96	150
6	Below average	0	0	1	4	5
	Total (%)	10 (3.3%)	38 (12.7%)	74 (24.7%)	178 (59.3%)	300 (100%)

Table 6: Students' regularity in lectures/classes.

S.no.	IQ category	Regular students	Irregular students	Occasionally attending	Total
1	Extraordinary Genius	5	0	0	5
2.	Genius	10	0	0	10
3.	Gifted	15	0	0	15
4	Above average	108	03	4	115
5	Average	135	8	7	150
6	Below average	3	1	1	5
	Total (%)	276 (92%)	12 (4%)	12 (4%)	300 (100%)

DISCUSSION

IQ scores had been used in the past as predictors of educational achievement or special needs, by social scientists who study the distribution of IQ scores in populations and the relationships between IQ score and other variables, and as predictors of job performance and income.[11-16] similarly in this study the academic performance, the socioeconomic status and time spent on studies by medical students was analysed in association with their IQ.

In the study all the subjects (medical students) had an IQ / intelligence interval above 70; none was mentally

challenged. Majority of the students had an IQ in range of 80 to 130 (average and above average IQ) without significant gender difference and only 30(10%) had gifted/genius or extraordinary IQ.

Similarly in study "A retrospective review of the neuropsychological test performance of physicians referred for medical infractions" by William P.et al, the IQ of medical professional was found to be average. The study also mentioned declining in the intellectual calibre of the entering medical student.[17]

Other studies have suggested that the mean I.Q. of individuals with medical degrees is 125 (Matarazzo & Goldstein, 1972; Wechsler, 1972), in our study most of the students had IQ in between 85 to 129 i.e. average and above average IQ.[18,19]

In the study students with average IQ needed one or more years for preparation of medical entrance exams, while the other students with higher IQ needed less time for this. Also students with average IQ compensated their routine activities for sake of studies and good results in the semester exam whereas students with higher IQ spent lesser hours in their studies and performed well. It was seen that students with average IQ had almost similar academic performance as compared to students with higher IQ , but it was due to long study hours devoted by them (table 3 and 5). So the academic performance had direct relation with number of attempts during medical entrance, number of study hours, and regularity in the classes. Similar findings were illustrated in the study by Abel Gedefaw et al where university entrance examination results, missing lectures and missing seminars/ tutorials had a statistically significant correlation with academic performance.[20]

The medical course comprises of lot of demonstrations, skills illustrations and practical work, so students attending all these activities will definitely get benefitted, and this may be cause for good performance of genius students (found to be regular) in their academics without devoting much of time in self studies, students with lower IQ (above average, average and below average) who use to bunk from the classes needed extra effort (Table 6). This has been supported by The American Psychological Association's report Intelligence: Knowns and Unknowns (1995).[21] wherever it has been studied, children with high scores on tests of intelligence tend to learn more of what is taught in school than their lower-scoring peers. [21]

The students with higher IQ belong to upper socioeconomic class and their parents were well educated. The educational qualification of mothers of these students was found to be higher than rest of the students. It signifies that the family environment, childhood nutrition and illnesses and schooling may have determinative role in the adult intelligence. The fact is supported by a 2003 study by Eric Turkheimer et al, who demonstrated that the proportions of IQ variance attributable to genes and environment vary with socioeconomic status. They found that in impoverished families, 60% of the variance in IQ is accounted for by the shared environment, and the contribution of genes was close to zero.[22]

Most of the medical students had average IQ or above average IQ. Only very few students had extraordinary /genius or gifted intelligence. Students with poor IQ/mentally challenged were not able to clear medical entrance. Students with higher IQ and above average IQ needed lesser time for medical entrance and even during MBBS course for class and routine studies.

Currently the selection of the student into the MBBS course is through an entrance test, conducted at the all-India level, state level or at the institution in some of the notified colleges and private institutions, for those who fulfil the eligibility criteria based on the marks achieved in the qualifying examination specified by the MCI.[23] Though the medical entrance exam is one of the toughest exams after IAS-UPSC/IIT-JEE and IIM-CAT, students with average/above average and even with below average IQ can get qualified in this through their regular, honest and consistent effort.

Limitation of number of attempts and age for medical entrance will be helpful to limit the entrance of below average / lower IQ students in MBBS course. It will hasten the duration MBBS completion as well as quality of healthcare provided by these professionals. A direct IQ test based admission process will hamper the moral of hard working average IQ students, so should not to be implemented. Inclusion of aptitude and reasoning questions in the entrance examination may be in favour of intelligent students and hard for bookworm students. Some medical institutions follow this approach, wherein the prospective students are provided with an opportunity to bring out the best potential in interpersonal skills, commitment, aptitude and personality traits that are suitable for the profession. This method is highly effective as narrated in the study (L. S. S. Manickam and T. S. Sathyanarayana Rao).[24]

One of the alternatives is to include Situational Judgment Tests (SJT) that presents the applicants with job-related situations and possible responses to the situations. These would help select candidates who are likely to excel in the profession.[25]

Limitations: the study subjects were from a single institute only; students from other medical college were not included due to lack of resources. The test applied on students was only an indicator of IQ, examination and testing by neuropsychiatrist would have yielded more definitive results. There were chances of recall bias by subjects regarding past information. Number of study hours on a daily basis; regularity in the classes were taken from the students response only, secondary evidences like classes attendance of individual students was not

recorded. Lack of literature and past studies were found in Indian context so comparison with other references was a bit difficult and incomplete.

CONCLUSIONS

The study found that students with near average IQ work hard in their studies and their academic performance was comparable and even better then higher IQ students. So IQ can`t be made the basis for medical entrance. This is also not fare because the students from middle and lower socioeconomic status generally had lower IQ as found in this study and other literatures. The government must give attention and restrict to the mushrooming, high cost medical coaching institutes who spoon-fed the expected questions of medical entrance to the rich students ahead of their intelligence while a genius student from middle class /poor family may be left out. Greater emphasis should be given to secondary school education and its marks may be included in merit formation as it has been done in all India engineering entrance exams. This will give an equal opportunity to students from both poor and rich families. Evaluation of interpersonal skills, commitment, aptitude and personality traits and inclusion of Situational Judgment Tests (SJT) are better alternative for the medical entrance exams. Limitation of attempts and age will further sort out poor IQ students.

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