Admission assessment criteria in predicting students' academic performance in newly established medical school

Criterios de evaluación de admisión para predecir el rendimiento académico de los estudiantes en la facultad de medicina recientemente establecida

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SUMMARY

Introduction: *Various medical education institutions around the world have different methods and criteria in selecting the ideal candidate. This study aims to determine the most appropriate admission criteria for predicting student academic performance in a newly established medical faculty in Indonesia.*
Methods: *In this cross-sectional study, we collected admission and academic performance data from 140 students admitted in 2016, 2017, and 2019. Data included academic ability test results, psychological test recommendation, and Intelligence Quotient (IQ) during admission.*
Results: *There was a significant correlation between students' academic ability test results and IQ with academic performance (p<0.05), with a very weak level of correlation (r= 0.1888 and r= 0.278, respectively). On the other hand, there was no significant correlation between the students'* psychological test recommendations and academic performance. IQ affected 22.7 % of student academic performance, and the academic ability test results and IQ, simultaneously, affected academic performance (p<0.05), as much as 5.4 %.
Conclusion: *Intelligent quotients were the most capable of predicting students' academic performance in the admissions process to evaluate medical students' cognitive and non-cognitive aspects.*

Keyword: *Assessment criteria, IQ, students' academic performance.*

RESUMEN

Introducción: *Varias instituciones de educación médica de todo el mundo tienen diferentes métodos y criterios para seleccionar al candidato ideal. Este estudio tiene como objetivo determinar los criterios de*

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admisión más apropiados para predecir el rendimiento académico de los estudiantes en una facultad de medicina recientemente establecida en Indonesia.

Métodos: *En este estudio transversal, recolectamos datos de admisión y rendimiento académico de 140 estudiantes admitidos en 2016, 2017 y 2019. Los datos incluyeron resultados de pruebas de capacidad académica, recomendación de pruebas psicológicas y Cociente de Inteligencia (CI) durante la admisión.*

Resultados: *Hubo una correlación significativa entre los resultados de las pruebas de capacidad académica de los estudiantes y el coeficiente intelectual con el rendimiento académico (p<0.05), con un nivel de correlación muy débil (r= 0.1888 yr= 0.278, respectivamente). Por otro lado, no hubo una correlación significativa entre las recomendaciones de las pruebas psicológicas de los estudiantes y el rendimiento académico. El coeficiente intelectual afectó el 22,7% del rendimiento académico de los estudiantes, y los resultados de las pruebas de capacidad académica y el coeficiente intelectual, simultáneamente, afectaron el rendimiento académico (p<0,05), hasta un 5,4%.*

Conclusión: *Los cocientes inteligentes fueron los más capaces de predecir el rendimiento académico de los estudiantes en el proceso de admisión para evaluar los aspectos cognitivos y no cognitivos de los estudiantes de medicina.*

Palabras clave: *Criterios de evaluación, coeficiente intelectual, rendimiento académico de los estudiantes.*

INTRODUCTION

Students are referred to as intellectual candidates or students who can improve their achievement in society are known as agents of change (1). The study program on health is indeed the most popular study program when entering university (2). The Faculty of Medicine is in great demand by the wider community. Therefore, a valid admission selection mechanism is needed to acquire a good quality of student input (3). The admission selection is generally carried out by assessing cognitive and non-cognitive aspects. In the cognitive aspect, conventionally, pre-admission assessments aim to cover academic and non-academic cognitive variables (4). Cognitive tests are needed to assess problem-solving skills, which are often reflected in intellectual abilities, performance on exams recalling factual information or memory, and language skill tests (5). The non-cognitive

aspects of the selection of new students are expected to assess 'non-cognitive' or personal qualities, including features, such as personality attributes, attitudes, interests, values, and other personal characteristics (6,7).

Various medical education institutions worldwide have different methods and criteria in selecting the ideal candidate, including cognitive and non-cognitive criteria (8). Academic performance is a criterion for assessing success in education (9). The tests carried out are expected to predict student academic performance or outcomes during the education period. If the test carried out has been a good predictor, the student input obtained will also be of higher quality, and the learning process can run smoothly (10). However, choosing the criteria of admission selection that has proven valid as a predictor of student academic performance is not easy. Several universities' research gives different predictive validity test results. There is a predictive validity of academic tests on the admission process in academic achievement, whereas the psychological characteristics have no significant association with the academic achievement (11). However, on the other hand, a cohort study in health colleges showed that cognitive ability tests at admission and previous academic performance did not predict student academic performance (12). The medical program's psychometric and psychological method also has good predictive validity (13).

The medical doctor profession itself requires three components of ability: a combination of three essential elements of medical knowledge, procedural or technical skills, and personality that contribute to physicians' performance in training and physicians' practice (6). The admission selection implemented should be able to filter students with the right qualifications in these three aspects. Regardless of the selected admission criteria, maintaining competitiveness in selecting new students poses a significant challenge for newly established medical institutions, where the number of applicants for new student candidates is still lacking (14). Therefore, there was a need for appropriate methods and criteria to get qualified and competitive student input yet still meeting the available quota. Based on this description, a study is needed to analyze how the predictive validity of the admission selection criteria affects

medical students' academic performance. This study aims to determine the most appropriate admission criteria for predicting student academic performance in a newly established medical faculty in Indonesia.

METHODS

We conducted this analytic observational research with a cross-sectional design at the Faculty of Medicine, Universitas Muhammadiyah Surabaya, Indonesia, from January to March 2021. The population in this study were students admitted in 2016, 2017, and 2018. We collected 140 students that met the inclusion criteria, namely students who were active and had complete data. The minimum sample size used in this study is calculated based on the cross-sectional research formula:

$$n = \frac{Z^2_{1-\alpha/2} \, p \, (1-p) \, N}{d^2(N-1) + Z^2_{1-\alpha/2} \, p \, (1-p)}$$

Based on the formula above, the minimum sample is 109. The sampling technique was carried out by the consecutive sampling method.

Collected data included student characteristics such as sex, high school origin, age, and year of admission; admission criteria selection for new students, namely academic ability test results, psychological test recommendations, and IQ; and academic performance indicator, which is the GPA. Academic performance was obtained from student achievement index data in the second year.

This research procedure was carried out by first making a proposal and arranging permits. The required ethical approval was obtained from the Komite Etik Penelitian Kesehatan (KEPK), Universitas Muhammadiyah Surabaya, Indonesia. To ensure confidentiality, the primary researcher coded the data in line with the institutional ethical guideline. The data obtained were then analyzed using the Statistical Package for the Social Sciences (SPSS) version 26 application using the correlation test and continued with the linear regression test if the significant results founded.

RESULTS

Table 1 shows that most of the respondent is females (63 %), comes from a public school (67 %), the majority is 18 years old (46 %), and the majority of student admissions is in 2016 (35.7 %).

Table 1

Characteristics of research subjects

Characteristics		N	%
Sex	Males	52	37
	Females	88	63
High school origin	Public school	94	67
	Private school	46	33
Age during admission (year)	16	3	2
	17	33	24
	18	65	46
	19	24	17
	20	9	6
	21	4	3
	22	1	1
	24	1	1
Year of admission	2016	50	35.7
	2017	44	31.4
	2018	46	32.9

Table 2 shows that there is a significant correlation between students' academic ability test results and IQ with academic performance (p<0.05), with a very weak level of correlation (r= 0.1888 and r= 0.278, respectively). On the other hand, there was no significant correlation between the students' psychological test recommendations and academic performance.

Table 2

Results of the Spearman Correlation Test Analysis

Variable	Academic performance (second year cGPA)
Academic ability test results	r = 0.188 P < 0.05* n = 140
Psychological test recommendations	r = 0.062 P > 0.464 n = 140
IQ	r = 0.278 P < 0.05* n = 140

* shows significant result
cGPA = cumulative Grade Point Average; IQ = Intelligent Quotients

The linear regression test was then carried out to the significant results. Table 3 shows the results of the linear regression test between the academic ability test results and the IQ on student academic performance. It is found that IQ affected academic performance where the correlation coefficient value was 0.227, indicating that IQ affects 22.7 % of student academic performance by itself (p<0.05). Meanwhile, academic ability test scores did not affect GPA.

The linear regression test between the academic ability test and IQ simultaneously on students' academic performance based on the test seen in Table 3 shows that the results of the academic ability test and IQ simultaneously affect academic performance (p<0.05), with a correlation coefficient of 5.4 %.

Table 3

Linear regression test between the academic ability test and IQ on the students' academic performance

Variable	Coefficient correlation R2	p
Academic ability test results	0.039	0.640
IQ	0.227	0.007*

* shows significant result
IQ = Intelligent Quotients

DISCUSSION

The characteristics of the respondents analyzed in this study included sex, age, and high school origin. From the data of 140 students, most of them were female. Female medical students tend to be more competitive, hard workers, and care more about their academic performance (2). The sample age of this study was 16-24 years, with the most significant age being 18 years. The age is far above the average because prospective students have previously studied at other faculties. The data regarding the origin of high schools in our study sample were 67% from public high schools and 33% from private high schools. This data are also following the Indonesian Ministry of Education and Culture, showing that even though many private high schools are emerging, the number of public high schools in Indonesia is still much higher, reaching more than two-fold (15).

The new student admission test is an essential process in screening students who enter a college. In Indonesia, the entrance selection test for private universities is carried out independently through several stages. This selection test was carried out in this study using several criteria, namely academic ability tests, psychological tests, interviews, and physical examinations. The academic ability test consists of 100 questions representing five disciplines (20 questions each): Biology, Chemistry, Physics, Mathematics, and English. This study discusses the effect of academic ability tests, psychological test results, and IQ scores on student academic performance.

The academic ability test, which was carried out on selecting new students, aims to test the participants' cognitive abilities. It contained test questions for academic ability such as

Mathematics, English, Indonesian, and Science questions. There was a correlation between the test of academic ability and student academic performance (p<0.05). This study is following the research conducted on 97 respondents in the Medical Faculty of Swadaya Gunung Jati University, which showed that the academic selection test had a significant relationship with the preclinical cumulative GPA (13). Likewise, a study with 116 respondents from Abulyatama Medical Faculty obtained results in establishing a significant relationship between the students' entrance examination results and their GPA (16). Student ability in academic performance achieved can be seen in the GPA (cognitive aspects) (17).

Weak academic ability tests in predicting student academic performance can be seen from the value of the linear regression test, which shows no significant correlation between tests of students' academic ability and academic performance. The basic academic ability test, or what is known as the traditional entrance screening test, is considered to be less able to predict students' ability in the educational process (10,11). However, if this test is carried out correctly, it can be used as a valuable measuring tool because knowledge and skills can predict how the person will learn and develop in the future (18).

The IQ and academic ability test result simultaneously affected academic performance (p<0.05), indicating that the cognitive test results are a good and consistent predictor of performance in education. However, because the correlation is still weak, the test's quality and validity need to be reviewed (13). Research conducted in Saudi Arabia explained that cognitive assessment as a student selection could also be assessed with other cognitive parameters. In that study, the most reliable academic assessment in predicting academic performance is the NAT (National Achievement Test) in assessing the cumulative knowledge acquired throughout the final three years of high school in five subjects: Biology, Chemistry, Physics, Mathematics, and English (4). Therefore, during admission selection, the NAT score can be considered one of the criteria for making decisions or as a requirement for passing the preadmission test.

Student academic performance can also be predicted by assessing non-academic cognitive abilities such as the GAT (general aptitude test score). This test aims to measure verbal mastery, quantitative mastery, analytical writing, and students' critical thinking skills through a long-term learning process. Various scientific reports have shown a positive correlation between the GAT and educational scores in various academic programs (11,18,19). In conclusion, it is necessary to consider the GAT in selecting new student admissions besides the academic ability test, considering that in addition to correlating with academic performance. Although they are sometimes viewed as lacking validity and acting as barriers to certain groups of applicants, aptitude tests and academic record are viewed as most useful in the decision of whom to call to interview, and this test is a good predictor of clinical performance needed for medical students (18,20).

Medical education provides demands for students to have noncognitive competencies in addition to cognitive aspects. In this study, the noncognitive aspects of students were assessed by psychological tests. Students' individual characteristics are summarized in a psychogram that provides information about the level of intelligence (IQ), general abilities, abilities and work styles, and personality. One of the challenges for a newly established faculty is poor opportunities for promotion so that the number of applicants is still relatively small (14). The test is carried out only to measure the potential where the manifestation can be influenced by various other things both from within and from outside the student.

CONCLUSIONS

In the admission selection, the selected selection criteria could predict second-year students' academic performance even with a very weak level of correlation. Among all criteria, IQ was the most capable of predicting students' second-year academic performance. The results could indicate the need to reevaluate the admission criteria for our medical faculty because more valid criteria are needed in the admission process to evaluate the cognitive and non-cognitive aspects of medical students.

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Conflicts of Interest

The authors declare no conflict of interest.

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