Correlations Between Entrance Examination Scores and Academic Performance Following Admission

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Purpose: The present study was conducted to compare students’ entrance examination scores for a school and their grades following admission to discuss the methods for implementing screening tests and advice or guidance for students admitted to the school.

Subjects and Methods: The subjects were students who took the general entrance examination for the Faculty of Medicine of Juntendo University and were admitted between 2004 and 2006. The entrance examination scores and academic performance were converted using a scale of one to 100, and Pearson’s product–moment correlation coefficient was calculated.

Results: There were significant correlations between the English test scores for the entrance examination and academic performance in many subjects. On the other hand, there were non-significant negative correlations between the mathematics test scores for the entrance examination and academic performance in many other subjects.

Conclusion: Students’ English test scores for the entrance examination are important since their academic performance following admission can be predicted from them. Students’ mathematics test scores for the entrance examination were negatively correlated with their academic performance in many subjects. Therefore, when students are provided with guidance for learning following admission, their mathematics scores should be taken into consideration.

Key words: entrance examination scores, academic performance, English test scores, mathematics test scores.

Background

Larger numbers of students have been admitted to medical departments since 2008 as one of the measures to address the issues of significant inequalities in the distribution of physicians among different regions of Japan and their severe shortage 3). Between 2007 and 2014, the capacity to accommodate new medical students increased from 7,625 to 9,061 2). Various types of reform, including those in systems for entrance examinations and postgraduate training, are in progress to train professionals who can provide high-quality health care to respond to social needs. On the other hand, a decline in the academic ability of students at a national level has been pointed out 3), and “the working group (WG) report on a decline in the academic ability of students” submitted by the Association of Japanese Medical Colleges in 2011 suggested that 86% of all teachers had recognized the decline in the academic ability of students 4). Since the increase in capacity in 2008, there have been increases in the numbers of first- and second-year students who repeat a grade, take a leave of absence from school, or withdraw from it 3), which is consistent with the above-mentioned report.

To help develop methods for training skilled...
physicians, it is essential to conduct systematic research of screening methods, academic performance, and assessment of students as physicians. There have been studies on the correlations between the scores on entrance examinations and academic performance in each school year. However, few studies have focused on the correlations between the subjects for the entrance examination and all academic achievements between the first year and graduation, including the national examination for physicians. The subjects of the present study were physicians who had passed the general entrance examination of the Faculty of Medicine of Juntendo University and graduated from it between 2010 and 2012. In this study, the correlations between students’ entrance examination scores and their academic performance were examined and analyzed.

Subjects and methods

1. Subjects
There were 198 people who had passed the general entrance examination of the university between 2004 and 2006 and graduated from it between 2010 and 2012 without repeating a school year, and 132 of them (95 males and 37 females) whose academic performance data in all subjects had been available were selected as the subjects (Ten students who had repeated a school year or withdrawn and those who had failed to inform us of their scores for the national examination for physicians were excluded from the study).

2. Academic grades as subjects for analysis
The subjects for analysis were students’ scores for English, mathematics, and science (two subjects are selected from physics, chemistry, and biology: scores for each test were available) tests in the entrance examination created by the Faculty of Medicine of Juntendo University.

Their grades in the following ten subjects while they were enrolled in the school were also analyzed:
(1) Liberal arts: Mean test score for the following compulsory subjects in the liberal arts course in the first year: medical anthropology, introduction to medicine, two English subjects, and sports and health.
(2) Anatomy: Mean scores for the test on anatomy.
(3) Basic medicine: Mean scores for the test on lectures in basic medicine.
(4) Clinical medicine: Mean scores for the test on lectures in clinical medicine.
(6) Common OSCE: Objective Structured Clinical Examination.
(7) Education to prepare for clinical training: Education (consisting of lectures and practical training sessions) to help students prepare themselves for medical interviews, infection prevention, techniques for physical examinations and diagnoses, basic procedures, clinical tests, and training for general diagnosis.
(8) Clinical training: Mean scores given by supervisors for students in groups in training at Juntendo University Hospitals.
(9) Graduation examination: Mean scores for eight graduation examinations taken by eight clinical department–specific groups of students.
(10) National examination for physicians: Mean scores for the national examination including general, clinical, and compulsory questions.

The university has adopted a system for integrated basic medicine curriculums, and examinations on anatomy and other basic medicine subjects are conducted in different curriculum units separately. Therefore, in the present study, anatomy and other subjects related to basic medicine are regarded as different subjects.

3. Analysis method
In the present study, SPSS Statistics 17.0J for Windows, statistical software, was used. The study also adopted the Kolmogorov–Smirnov test to examine whether or not data are normally distributed.

In addition, scatter plots were used to identify outliers for all items. Pearson’s product-moment correlation coefficient was calculated to determine correlations between the entrance examination scores and academic performance. The significance level was $p < 0.05$ (*: $p < 0.05$, **: $p < 0.01$). The entrance examination scores and academic performance were converted using a scale of one to 100.
4. Handling of data
The present study was conducted with the approval of the ethics committee of Juntendo University (Approval number: 2012006, Medical Ethics Committee of Juntendo University). Data were obtained in a manner so that individuals could not be identified. For data management, a personal computer solely for data processing and without access to the Internet was used, in addition to a ban on taking out data to ensure the safety of information. Only scores and grades received by the subjects who had provided written consent to the study were analyzed.

Results

1. Correlations between the mean entrance examination scores and academic performance following admission
The entrance examination includes English, mathematics, and two optional science tests (from biology, chemistry, and physics). Correlations were examined between the mean scores for the four tests in the entrance examination and academic performance following admission, and the mean scores for the four tests were significantly correlated with the scores for the test in clinical medicine and graduation examination (Figure-1). In the following paragraphs, correlations were examined between the score for each of the four tests in the entrance examination and academic performance following admission.

2. Correlation between the scores for the English test in the entrance examination and academic performance following admission (Figure-2)
There were significant correlations between the scores for the English test in the entrance examination and those for multiple tests in the school: basic medicine ($r = 0.182, p < 0.05$), anatomy ($r = 0.190, p < 0.05$), clinical medicine ($r = 0.246, p < 0.01$), CBT ($r = 0.208, p < 0.05$), education to prepare for clinical training ($r = 0.331, p < 0.01$), and the national examination for physicians ($r = 0.319, p < 0.01$). The higher the grade, the higher the correlations between the English test score in the entrance examination and academic performance.

3. Correlation between the scores for the mathematics test in the entrance examination and academic performance following admission (Figure-3)
There were non-significant negative correlations between the scores for the mathematics test in the entrance examination and academic performance in many subjects. The scores for the mathematics test in the entrance examination were negatively correlated with the scores for the tests in anatomy ($r = -0.154$) and education to prepare for clinical training ($r = -0.147$) in particular. The higher the

Figure-1 Correlations between the mean scores for the entrance examination and academic performance following admission
The vertical axis represents the correlation coefficient and horizontal axis expresses the academic performance in different subjects following admission. The subjects for the lower grades are on the left, and those for the higher grades are on the right. There were no significant correlations between the mean scores for the entrance examination and academic performance in subjects excluding clinical training.

*: $p < 0.05$, **: $p < 0.01$ (two-sided test)
mathematics test scores, the lower the scores for tests in anatomy and education to prepare for clinical training, being contrary to the English test scores in the entrance examination.

4. Correlation between the scores for the science test in the entrance examination and academic performance following admission (Figure-4)

There were no significant correlations between
the scores for the science test in the entrance examination and academic performance following admission.

Discussion

There were significant correlations between the scores for the English test in the entrance examination and academic performance in many subjects (Figure-2). The higher the grade, the higher the correlations between the English test score in the entrance examination and academic performance in multiple subjects. According to a survey of academic achievements conducted by Kamata et al., the English skills of high school students have been improving in recent years\(^7\), and students in the upper grades are particularly interested in medical English\(^8\). A study conducted by Kondo et al\(^9\), classified medical students' motivations to study English into three groups: motivations related to work, interest, and cultural knowledge, and work-related motivations (medical literature reading comprehension, creation of reports and papers, research presentations, and dealing with foreign patients, etc.) ranked first. Motivation has positive and long-term effects when viewed from the standpoint of educational psychology\(^10\). Students who received high scores for the English test in the entrance examination had a clear sense of purpose, and it influenced not only their English study but also their ability to learn medical knowledge, which is directly related to their practice in the future, skills required for clinical training, and national examination for physicians scores. The higher the grade, the higher the correlations between the English test score in the entrance examination and academic performance in other subjects, presumably because medical students in the upper grades are required to study English more, or their motivation to learn it and sense of purpose become stronger. On the other hand, although a positive correlation was found between English test scores for the entrance examination and scores of clinical training and the OSCE, it was not significant. For clinical training and the OSCE, it is instead necessary to examine the correlation between postgraduate clinical training evaluations in another research project.

There were negative correlations between the scores for the mathematics test in the entrance examination and academic performance in many other subjects following admission (Figure-3), which is consistent with the results of previous studies\(^6\). Mathematics tests can assess the ability of a person to think theoretically, including mental flexibility. This ability of students will have an important meaning when they provide patients with health care in the near future as physicians. However, medical students are required to exert consistent efforts for a long period of time to acquire knowledge. Students with "a quick mind", as
required in mathematics, may not be good at memorizing—for example, an ability to conduct anatomical studies. The results of the present study suggest that students that are good at mathematical or logical thinking may not be good at acquiring medical knowledge through learning based on memorization. From the viewpoint of student guidance, it is important to discuss the type of guidance that should be provided for students good at mathematical thinking and poor at learning based on memorization, and how these two thinking-based approaches should be linked to each other.

There were no significant correlations between the scores for the science test in the entrance examination and academic performance following admission; academic performance was not correlated with the score for the test in physics, chemistry, or biology. Since a wider range of knowledge is required for medicine than the science test in the entrance examination, students' attitudes toward learning after they are admitted to the university are also important in addition to basic academic skills in science.

Previous studies also support the results of the present study: English test scores in the entrance examination are correlated with the academic performance following admission, and mathematics test scores in the entrance examination are negatively correlated with the performance. However, it should be noted that there are significant differences between the present and previous studies. According to the results of previous studies, English test scores in the entrance examination were correlated with the academic performance when the successful applicants received higher scores for arts subjects in the National Center Test for University Admissions, whereas mathematics test scores in the entrance examination were negatively correlated with the academic performance when the applicants received higher scores for science subjects in the national center test. Academic performance adopted in the present study was calculated based on the mean scores for examinations conducted in the first-to-third school years. The entrance examination of the university requires all applicants to take English and mathematics tests, and decisions on admissions are based on the total score for English, mathematics, and science tests. In other words, as such decisions are not biased, a valid comparison of all successful applicants can be conducted. It is notable that the present study involved not only students' grades in their first- and second-year but also their scores for graduation and national examinations for physicians, and the results suggest that the higher the grade, the higher the correlations between the English test score in the entrance examination and academic performance, as described in the preceding paragraphs. The conclusions of this research in no way changed even though the scores of some repeaters (not all because some had entrance years outside of the 2004–2006 research period) were included in the examination. Additionally, as repeaters have two scores (first and second years of the same grade) for some academic performance, it was difficult to decide which score to use. Repeater were therefore excluded from the subjects.

However, it should be noted that the present study only involved the Faculty of Medicine of a single university, and, therefore, the results may not be generalized. As a future challenge, it will be necessary to conduct further research to examine the relationship between students' English test scores for the entrance examination and their performance as physicians following graduation.

**Conclusion**

The results of the present study established the validity of the method for the existing entrance examination adopted by the university. It is necessary to place importance on students' scores for the English test in the entrance examination as the scores may indicate their academic performance following admission. There is a possibility of academic performance improving after entrance if the English test score is more greatly emphasized for the entrance examination. However, as we have to consider a host of other factors, it is necessary to examine this matter with great care. On the other hand, since their scores for the mathematics test in the entrance examination were negatively correlated with their academic performance, these scores should be taken into consideration when students are provided with guidance for learning following admission.

These results indicate that it is important to
motivate students, especially those who are quick-minded but less adept at simple memorization, to study medicine by providing them with a comprehensive overview of medicine in the early stages after entrance to medical school.

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