Predictive value of entrance test with the academic achievement of medical students

R K Ningrum* and N W D Ekayani
Medical Education Unit, Faculty of Medicine and Health Sciences, Warmadewa University, Bali, Indonesia

*rimakusumaningrum@warmadewa.ac.id

Abstract. A medical student must pass rigorous entrance tests including academic test, academic potential test, health test, and interview test. The test is expected to have predictive value for the academic achievement of students reflected in block test. This study aims to predict the entrance test with academic achievement. This study correlates academic test and academic potential test with block tests in the first semester for student academic year 2018 (n= 106 students). Spearman correlation was conducted to determine the correlation between academic test and academic potential test with block test students in semester 1. There were negative correlations of academic test with block test (-0.254, p<0.05) and positive correlations of academic potential test with block test (0.457, p<0.01) in the first semester. This study shows that the students who have high academic test has lower block test and students who have high academic potential test have a higher block test. The academic potential test can predict the academic achievement of medical students.

1. Introduction
The entrance test is an important part of the university. This test aims to attract new students who have sufficient academic ability to go through the learning process at the university and potential to succeed in the fields they have chosen. In addition, the entrance test is also used to predict student academic achievement. The entrance test score can also be used to predict the length of the study [1]. Every university has its own criteria and methods in the implementation of new student selection. Methods of selection generally can be grouped into two types namely cognitive and non-cognitive [2]. Several entrance tests conducted by the university, such as academic test, potential academic test, psychological test, health test, and interview test. The Faculty of Medicine and Health Sciences (FMHS) of Warmadewa University is also conducted several entrance tests, consisted of the academic test, potential academic test, health test, and interview test to select candidate medical students. Subsequently, after passing the academic test, potential academic test, health test, the candidate can proceed to the interview test.

After graduation, doctors are expected to provide the highest quality of medical care services. Considering this fact, the university must pay more attention to design an entrance test to ensure the qualified students meet the required standards. Entrance test has been assigned to play an important role to predict academic achievement of medical students [2]. Academic achievement of medical students is one indicator of learning processes that capture the quality of students. Academic achievement can be assessed based on cognitive, affective and psychomotor aspects. Cognitive aspect in FMHS of
Warmadewa University is evaluated by the block test. The block test is carried out at the end of the block period which consists of several items based on the university credits unit of the given block. This study aimed to predict the entrance test of academic achievement of medical students at Warmadewa University.

2. Methods
This study is cross-sectional analytical description research. Participants of this research were undergraduate medical students in the first year (the academic year 2018) FMHS of Warmadewa University. There were 106 medical students that consisted of 51 males and 55 females. Entrance test as the predictive value was reflected by academic test and academic potential test. The academic test consists of biology, chemistry, physics, mathematics, Indonesian and English language. Total of the academic test is 120 MCQs. The MCQs were five answer choices with one the best answer. The tests based on colleges’ national exam syllabus. These questions were not consisting of vignette but only the lead in of question. Whereas academic potential test consists of three subtests, such as verbal, quantitative, and figural. This test was analysed by psychologists.

The students had passed four blocks in first semester, such as Block 1.1 General Studies (4 credits), Block 1.2 The Human Body: from cell to person (5 credits), Block 1.3 Human Growth Development (3 credits), and Block 1.4 Basic Principles of Pathological Processes and Therapy (5 credits). At the end of the block, students had a block test that MCQ with one the best answer. It consists of 75-100 multiple choice questions (MCQ) based on assessment blueprint. All block consists of 100 MCQs, except Block 1.3 Human Growth Development that consist of 75 MCQs. Block teams collect the questions from the lecturer and send them to the assessment team. Assessment team reviews the question according to the standard of writing question and blueprint assessment. Standard questions of the block consist of a vignette, lead in and five answer choices (one the answer and four distractors). Blueprint assessment based on the meeting conducted by the curriculum team, assessment team and block team. The blueprint is listed in the block book so students can find out the portion of each learning outcome. Assessment team reviews the content of the question with lecturers to ensure content validity. All questions had been reviewed and accordance with blueprint would be tested to the students. The results of block tests were an actual mark.

The bivariable analysis was used to examine the relationship between entrance test and academic achievement. Normality of data was tested by Kolmogorov Smirnov test. The results were not normal. Based on that analysis, this research used Spearman correlation. Other analyse use the Chi-square to a comparison of achievement male and female.

3. Result and discussion
There were 106 students participated in this study. Males had a higher test result in academic test and academic potential test but lower test results in all block tests than female. These differences were not significant (p<0.05), except Block 1.3 Human Growth and Development (p=0.012) and Block 1.4 Basic Principles of Pathologic Processes and Therapy (p=0.002). The results are summarized in Table 1. In academic test and academic potential test difference between male and female were 1.89 and 4.04. This research showed that academic test had low negative correlation with block test. It means that medical student who had higher score in academic test had lower score in block test. The correlation was consistent in four block and significant (p<0.05). It can be occurring because the academic test consists of the subject that not relevant to with the subject in medical education, such as physics and mathematics. This result showed that marks in subject mathematics, physics and chemistry had negative correlation with final success scores in engineering courses [3].
Table 1. Comparison of mean entrance test and block test in male and female.

| Gender       | Academic test | Academic potential test | GS    | THB    | HGD    | BP3T   |
|--------------|---------------|-------------------------|-------|--------|--------|--------|
| Male (n=51)  | 58.24         | 409.42                  | 67.59 | 55.45  | 45.69  | 48.49  |
| Female (n=55)| 56.35         | 405.38                  | 71.96 | 59.56  | 51.36  | 55.46  |
| P            | 0.371         | 0.877                   | 0.025 | 0.220  | 0.012* | 0.002**|

GS: Block 1.1 General Studies, THB: Block 1.2 The Human Body: from cell to person, HGD: 1.3 Human Growth and Development, BP3T: Block 1.4 Basic Principles of Pathologic Processes and Therapy, * p<0.05, **p<0.01

However, other research in Saudi Arabia showed that National Achievement Test (NAT) can predict performance of medical student in preclinical years that reflect as cumulative grade point average. But it was not found to be predictive of performance in clinical years [3]. NAT were consist of biology, chemistry, physics, mathematics and English [3]. This test could be partially attributed to the test being focused on knowledge and cognitive of students [3]. Other study underlined that students’ mathematics test scores had negative correlation with academic performance [4].

A study reported that the academic test (biology, chemistry, physics, mathematics and English) has significant correlation by improving 16% of the GPA level and 11.9% average block score [5]. In Iran, Nationwide Konkoor examinations were not consistent predictor for academic achievement of medical students. This test showed weak correlation for mathematics and physics but strong correlation for biology [6]. The entrance test at the University of New South Wales (UNSW), Australia did not predict academic achievement but may have other useful roles in an integrated selection process [7].

Table 2 showed the correlation between the entrance test and block test. Each block had a low negative correlation with the academic test. It means that student who had high academic test had low block test. Different results are shown in the correlation of academic potential test and block test. All block tests had a moderate correlation with the academic potential test. Block 1.1 General Studies had the highest correlation.

Table 2. Correlation between entrance test and block test.

| Entrance test | Analysis | GS     | THB    | HGD    | BP3T   |
|---------------|----------|--------|--------|--------|--------|
| Academic test |          | - 0.204| - 0.270| - 0.289| - 0.221|
| P             |          | 0.036* | 0.005**| 0.003**| 0.023* |
| Academic potential test |          | 0.498  | 0.454  | 0.455  | 0.342  |
| P             |          | 0.000**| 0.000**| 0.000**| 0.000**|

*p<0.05, **p<0.01

There was a negative correlation of academic test with all block tests (-0.254, p<0.05). It means that the students who have high academic test have lower block test. Contrary result found about the correlation between academic potential test and block test. This study showed there was a positive correlation of academic potential test with all block tests (0.457, p<0.01). The students who have a high academic potential test, have higher block test. These results mean that academic test does not predict academic achievement of medical students in FMHS of Warmadewa University. But, the academic potential test can predict academic achievement of medical students, especially in the block test.

In Faculty of Medicine and Health Sciences Warmadewa University, academic potential test consist of three sub test such as verbal, quantitative and figural. It means that the higher of potential academic test, then students have greater chance to achieve high academic achievements. This test can predict the student with the analytical ability because block test requires that ability. Other countries have set-up different admission tests for entrance qualification of medical students. In United State, Medical College Admission Test (MCAT) score were strong predictors of United States Medical Licensing Examination (USMLE), particularly Step 1 [8-9]. In China, National College Entrance Examination(NCEE) is an important predictor of academic performance of medical students in first year [10]. In Australia, the admission test score can predict outcomes not only in early stage of graduate entry medical program but throughout the course [11-12]. At a higher bench of Scholastic Aptitude Test, a higher level of reasoning

3
skill is required in analyzing and processing information so that the individual can perform problem solving with the right solution. On other hand, other research showed contrary result about General Aptitude Test (GAT) that used to assess non-academic which composed of two sections (verbal and quantitative). It was stated from the study that GAT was found to be a significant negative predictors of preclinical achievement of medical students [3]. The entrance tests were weak correlation with outcome and career in Vanderbilt Medical Scientist Training Program [13]. This study is limited only one year students and one institution. Further research is needed to know correlation of each subject in academic test and academic potential test with academic achievement.

4. Conclusion
The entrance test is always an important issue for every university. Our results indicate that the students who have high academic test has lower block test and students who have high academic potential test have a higher block test. It can be concluded that academic potential test can be used as a predictor of academic achievement for medical students.

Acknowledge
Our special thanks to Dean Faculty of Medicine and Health Sciences Warmadewa University for supporting our research. Our special thanks also to others that support this research.

References
[1] Kruzicevic S M, Barisic K J, Banozic A, Esteban C D, Sapunar D and Puljak L 2012 Predictors of attrition and academic success of medical students: a 30-year retrospective study PLoS ONE 7(6) 6–9
[2] Yusoff M S B, Rahim A F A, Baba A A and Esa A R 2011 Medical student selection process and its pre-admission scores association with the new students’ academic performance in university sains Malaysia Int Med J 18(4) 329–33
[3] Dabaliz A A, Kaadan S, Dabbagh M M, Barakat A, Shareef M A, Al-Tannir M, et al 2017 Predictive validity of pre-admission assessments on medical student performance Int J Med Educ 8 408–13
[4] He S H, Kempe K A, Tomiki Y U and Nishizuka M A 2015 Correlations between entrance examination scores and academic performance following admission Juntendo Medical Journal 61(2) 142–8
[5] Permatasari T O 2016 Faktor kognitif dan non-kognitif pada seleksi mahasiswa baru sebagai prediktor terhadap prestasi akademik J Penelit dan Eval Pendidik 20(1) 80
[6] Farrokhi-khajeh-pasha Y, Nedjat S, Mohammad A, Rad EM, Majdzadeh R, Monajemi F, et al 2012 The validity of Iran’s national university entrance examination (Konkoor) for predicting medical students’ academic performance BMC Medical Education 12 60
[7] Simpson P L, Scicluna H A, Jones P D, Cole A, Sullivan A J O, Harris P G, et al 2014 Predictive validity of a new integrated selection process for medical school admission BMC Medical Education 14 86
[8] Julian E R 2005 Validity of the medical college admission test for predicting medical school performance Academic Medicine 80(10) 910–7
[9] Gauer J L, Wolff J M, Jackson J B, Gauer J L, Wolff J M, Do J B J, et al 2016 Do MCAT scores predict USMLE scores? An analysis on 5 years of medical student data Medical Education Online 21 1
[10] Zhou Y, Zhao Z, Li L, Wan C, Peng C, Yang J, et al 2014 Predictors of first-year GPA of medical students: a longitudinal study of 1285 matriculates in China BMC Medical Education 14 87
[11] Puddey I B and Mercer A 2014 Predicting academic outcomes in an Australian graduate entry medical programme BMC Medical Education 14 31
[12] Puddey I B, Mercer A, Andrich D and Styles I 2014 Practice effects in medical school entrance
testing with the undergraduate medicine and health sciences admission test (UMAT) BMC Medical Education 14 48
[13] Bills J L, Vanhouten J and Dermody T S 2016 Validity of the Medical College Admission Test for predicting MD – PhD student outcomes Adv Heal Sci Educ 21(1) 33–49