Correlations between Medical Students National Admission Test Score, Preclinical and Clinical Year Mean Cumulative GPA and UKDI Score

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Abstract **Objective**: The purpose of this study was to determine whether medical students' national admission test scores correlated with their preclinical and clinical year GPAs. We also sought to correlate their national admission test scores and GPAs with the Indonesian Medical Doctor Competency Examination (UKDI) score. **Method**: A retrospective cohort study was done based on past medical students' record. Samples were students admitted to the medical school commencing 2006 (after Competency-based Curriculum was implemented) and had passed their first-time UKDI. Data collection was conducted on medical school of four public universities who agreed to provide the data of their medical students' data. Correlation between variables was analyzed using a two-tailed Pearson correlation for normally distributed data, and Spearman's rho for non-normal distribution. **Result**: We found significant correlation between preclinical year GPA with basic math ($r=0.31$), with English ($r=0.35$; $r=0.38$), with Chemistry ($r=0.20$) and with physic ($r=0.20$). Clinical year GPA had a significant correlation with natural science math ($r=-0.20$), with chemistry ($r= 0.17$) and with English ($r = 0.12$; $r = 0.29$). UKDI score was correlated with Biology ($r = 0.29$), with Physic ($r = 0.20$; $r = 0.11$), and with chemistry ($r = 0.11$). UKDI score also had significant correlation with clinical year GPA ($r = 0.45$; $r = 0.23$; $r = 0.26$). UKDI score was significantly correlated with preclinical year GPA and the result was consistent on all medical schools; Andalas students ($r = 0.40$), Brawijaya students ($r = 0.49$), Hasanuddin students ($r = 0.37$), and Sriwijaya students ($r = 0.45$). **Conclusion**: National admission test scores were significantly correlated with preclinical and clinical year GPAs, and with UKDI scores, but the correlations were seen only on certain medical schools. Preclinical year GPA was significantly correlated with UKDI score and the result was consistent on all medical schools.

Keywords: UKDI, GPA, admission test

1. Background

Since 2005 Competency-based Curriculum (CBC) with integrated approach was implemented in Indonesian medical education (Santoso D, 2013). The change of curriculum was affected by the unmet need of competent clinicians for healthcare. The curriculum was meant to expose medical student with clinical knowledge prior to graduation from medical school (Wasisto B, 2013). The improvement in clinical knowledge and skill would increase the number of qualified clinicians in Indonesia who are able to compete with clinicians from other countries.

The implementation of CBChas to be consistent with the purpose of Basic Medical Education to create clinicians who meet public expectation and has the ability to adapt with progress of science and technology and the change in the healthcare system (Yusuf I, 2010).To ensure the quality of this new curriculum, there must be comprehensive assessment from input (admission) to outcome (competency achievement). However, there is limited published literature on this topic in Indonesia and were not comprehensively assessed (Suswati I, 2010; Salvandega WP *et al.*, 2011; Syafruddin A *et al.*, 2013).

The purpose of this study was to determine whether medical students' national admission test scores correlated with their preclinical and clinical year mean cumulative Grade Point Average (GPA). We also sought to correlate their national admission test scores and GPAs with the Indonesian Medical Doctor Competency Examination (UKDI) score. We used the context of Input-Process-

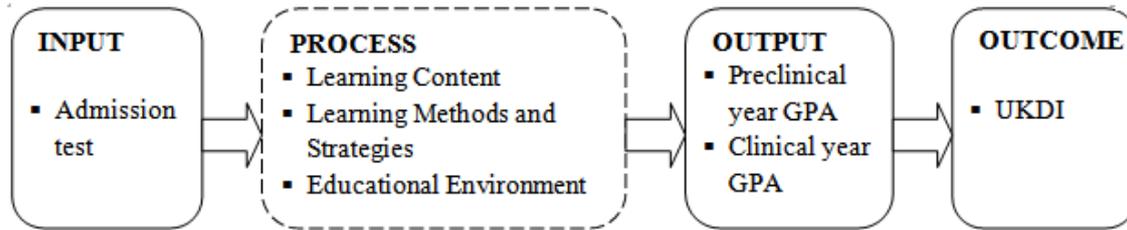Output-Outcome evaluation as the conceptual framework of our study (Figure 1).

Figure 1. The context of Input-Process-Output-Outcome evaluation for assessing educational quality

This concept argued that to demonstrate the effectiveness of CBC implementation, higher national admission test scores(*input*) should be consistently linear with the increase of preclinical and clinical year mean cumulative GPA (*output*) and subsequently UKDI score (*outcome*), provided all medical schools have similar *process*.

With this framework in mind, we posed several hypotheses:

1. The score of each subject tested in the national admission test will have a correlation with preclinical year mean cumulative GPA.
2. The score of each subject tested in the national admission test will have a correlation with clinical year mean cumulative GPA.
3. The score of each subject tested in the national admission test will have a correlation with UKDI score.
4. Preclinical and clinical year mean cumulative GPA will have a correlation with UKDI score.

2. Materials and Method

A retrospective cohort study was done based on past medical students' record. Samples were medical students admitted to the medical school commencing 2006 (after CBC was implemented) and had passed their first-time UKDI. UKDI is an exit exam for all medical school graduates before they are sworn as a medical doctor. The UKDI they attended had to be one of the three consecutive UKDI periods for each batch. Medical students included in the study will be excluded from the analysis if information on all required variables were not complete.

We collected medical students' National admission test score of subjects including Basic Math, Natural Science Math, Biology, Physic, Chemistry, and English. In addition, we collected their preclinical and clinical year mean cumulative GPA and UKDI scores. UKDI is the Indonesian clinician competency test that must be attended by medical school graduate if they require certification as a medical professional (STR) from the official national clinician organization (IDI). It consists of two tests in the form of Computer-based Test (CBT) and Objective Structured Clinical Examination (OSCE). The UKDI score collected in this study was the CBT score.

Data collection was conducted across medical school of four public universities who agreed to provide the data of their medical students' data; Andalas University, Brawijaya University, Hasanuddin University and Sriwijaya University. For the incomplete UKDI scores, we gained data from UKDI Committees.

2.1. Statistical Analysis

Descriptive statistics were calculated for each variable. Normal distribution was checked for each variable. Variables with normal distribution were described in mean and standard deviation (SD), otherwise were described in median and inter quartile range (IQR) (Stewart A, 2002). Correlation between national admission test scores, GPAs and UKDI score were analyzed using a two-tailed Pearson correlation test, except when two variables being correlated were not normally distributed we used Spearman's rho correlation. Strength of correlation was defined as weak ($r = 0$ to 0.20), moderate ($r = 0.21$ to 0.50), and strong ($r = 0.51$ to 1) (Zou KH *et al*., 2003). Statistical significance was set at $P < 0.05$. Correlation coefficients and *P* values were tabulated for each medical school and total. All data were analyzed using SPSS 21.0.

2.2. Ethics Approval

The study was approved by Hasanuddin University Health Research Ethics Committees and confidentiality was maintained by de-identifying data prior to analysis.

3. Results

All students included in the study have all variables information completed. None was excluded. Total samples were 319 students. Most students were female (65.2%) and those who attended UKDI in 2012 (53.3%) (Table 1).

Table 1. Student Characteristics

Student Characteristics	Andalas	Brawijaya	Hasanuddin	Sriwijaya	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
Total	102	69	78	70	319
Sex					
Male	28 (27.5%)	25 (36.2%)	33 (42.3%)	25 (35.7%)	111 (34.8%)
Female	74 (72.5%)	44 (63.8%)	45 (57.7%)	45 (64.3%)	208 (65.2%)
Year of UKDI					
2011	0 (0.0%)	0 (0.0%)	14 (17.9%)	66 (94.3%)	80 (25.1%)
2012	102 (100.0%)	0 (0.0%)	64 (82.1%)	4 (5.7%)	170 (53.3%)
2013	0 (0.0%)	69 (100.0%)	0 (0.0%)	0 (0.0%)	69 (21.6%)

At the time of data collection, all medical schools were accredited as "A" by the National Accreditation Board of Higher Education (BAN-PT). This was counted for 25% of all Indonesian medical schools with "A" accreditation status by the time this study were conducted.

Of all subjects tested in the national admission test, the highest mean score was basic math (71.6), as shown in Table 2. For this subject, students from Brawijaya Medical Schools had the highest median score compared to students from other medical schools. Subject with the lowest median score was physic. Mean total score of clinical year GPA was higher than preclinical year GPA (3.38 vs. 3.30). Brawijaya Medical School had the highest preclinical year GPA mean score whereas Hasanuddin Medical School had the highest clinical year GPA mean score. Furthermore, Andalas Medical School had the highest UKDI score amongst all.

Table 2. Descriptive statistics of all variables

	Andalas Mean (±SD)	Brawijaya Mean (±SD)	Hasanuddin Mean (±SD)	Sriwijaya Mean (±SD)	TOTAL Mean (±SD)
Basic Math	72.9 (13.2)	85.0 (10.8)	63.4 (15.2)	69.0 (19.0)[#]	71.6 (15.6)
Natural Science Math	30.3 (11.0)	27.8 (9.8)	22.0 (18.0)[#]	29.7 (10.2)	27.6 (11.6)
Biology	23.1 (8.1)	24.6 (7.5)	13.5 (14.0)[#]	23.0 (8.4)	23.6 (8.8)
Physic	12.5 (11)[#]	7.00 (13)[#]	13.5 (16.0)[#]	11.0 (12.0)[#]	11.0 (12.0)[#]
Chemistry	39.1 (8.9)	41.9 (8.6)	41.4 (8.4)	33.8 (11.3)	39.1 (9.8)
English	42.6 (13.3)	55.3 (14.3)	41.8 (18.2)	47.5 (15.7)	46.2 (16.2)
Preclinical Year GPA	3.19 (0.12)	3.66 (0.14)	2.97 (0.24)	3.50 (0.15)	3.30 (0.31)
Clinical Year GPA	3.21 (0.11)	3.49 (0.13)	3.67 (0.14)	3.32 (0.11)	3.38 (0.35)[#]
UKDI	77.6 (5.2)	74.7 (4.4)	77.3 (5.1)	72.7 (4.5)	76.5 (7)[#]

[#] Median (IQR)

There was a positive moderate correlation identified between preclinical year GPA and basic math among all students (r=0.31) as shown in Table 3. A positive moderate correlation was also identified with English among all students (r=0.35) and Sriwijaya students (r=0.38). Preclinical year GPA was also significantly correlated with Chemistry among Andalas students (r=0.20). Furthermore, there was a positive correlation between preclinical year GPA and physic among total students, but the correlation was weak (r=0.20).

Table 3. Bivariate Correlations of the Explanatory Variables and Preclinical Year GPA

Variables	Andalas n = 102	Brawijaya n = 69	Hasanuddin n = 78	Sriwijaya n = 70	TOTAL n = 319
Basic Math	-0.08	0.23	0.11	-0.12	0.31**
Natural Science Math	-0.07	0.04	-0.04	-0.03	0.11*
Biology	0.14	0.25*	0.00	0.07	0.04
Physic	0.15	0.07	-0.14	0.17	-0.16**
Chemistry	0.20*	0.06	0.17	0.21	0.01
English	0.01	0.14	0.22	0.38**	0.35**

Statistical test used Pearson Correlation
** p < 0.01,
* p< 0.05

Table 4 shows that clinical year GPA had a negative and weak correlation with natural science math among total students (r=-0.20),and a positive but weak correlation with chemistry among total students (r= 0.17). Clinical year GPA had a positive weak correlation with English among all students (r = 0.12) and a moderate correlation with English among Hasanuddin students (r = 0.29).

Table 4. Bivariate Correlations of the Explanatory Variables and Clinical Year GPA

Variables	Andalas n = 102	Brawijaya n = 69	Hasanuddin n = 78	Sriwijaya n = 70	TOTAL n = 319
Basic Math	0.04	0.02	0.06	0.06	-0.05
Natural Science Math	0.08	-0.14	0.04	0.03	-0.20ᵻ **
Biology	0.12	0.19	-0.14	0.01	0.10ᵻ
Physic	0.12	-0.08	-0.17	0.22	-0.02ᵻ
Chemistry	-0.03	0.08	0.06	0.12	0.17**
English	0.02	0.13	0.29*	0.21	0.12*

Statistical test used Pearson Correlation except ᵻ used Spearman's rho Correlation
** p < 0.01,
* p < 0.05

Table 5 shows that of all subjects tested in the national admission test, UKDI score was correlated with Biology among Brawijaya students(r = 0.29), with Physic among Andalas students (r = 0.20) and all students (r = 0.11), and with chemistry among all student (r = 0.11). Moreover, UKDI score had moderate correlations with clinical year GPA among Brawijaya students (r = 0.45), Hasanuddin students (r = 0.23), and Sriwijaya students (r = 0.26).

There was a unique pattern identified by our data. UKDI score was moderately correlated with preclinical year GPA and the result was consistent among each medical school; Andalas students (r = 0.40), Brawijaya

students ($r = 0.49$), Hasanuddin students ($r = 0.37$), and Sriwijaya students ($r = 0.45$). But when analyzed on all students without medical school separation, there was no correlation identified. The figure below depicts values of preclinical year GPA and UKDI score with color marker based on each medical school. The pattern for each medical school appeared to be showing a moderate trend line, but when all data combined without considering the color marker, the pattern did not show any trend line.

Table 5. Bivariate Correlations of the Explanatory Variables and UKDI scores

Variables	Andalas n = 102	Brawijaya n = 69	Hasanuddin n = 78	Sriwijaya n = 70	TOTAL n = 319
Basic Math	*-0.06*	*0.08*	*-0.08*	*-0.03*	*-0.04*
Natural Science Math	*-0.03*	*-0.19*	*-0.04*	*0.06*	*-0.07 ǂ*
Biology	*0.19*	*0.29**	*-0.01*	*-0.05*	*0.09 ǂ*
Physic	*0.20**	*-0.04*	*-0.08*	*0.11*	*0.11 ǂ **
Chemistry	*-0.03*	*0.18*	*0.06*	*0.04*	*0.11**
English	*0.09*	*0.03*	*0.15*	*0.08*	*0.00*
Preclinical Year GPA	*0.40***	*0.49***	*0.37***	*0.45***	*-0.06*
Clinical Year GPA	*0.04*	*0.45**	*0.23**	*0.26**	*0.08 ǂ*

Statistical test used Pearson Correlation except ǂ used Spearman's rho Correlation
** $p < 0.01$,
* $p < 0.05$

4. Discussion

The current study is the first assessment that analyses Indonesian medical students' performance from medical school admission to achievement of clinical competency. The findings of our study confirm and add new theory on the existing literature on factors associated with medical students' academic performance in medical school (Ferguson E *et al*., 2002).

In this study, not all subjects tested on the national admission test were correlated with preclinical year GPA. When the correlation did exist on some subjects, the strength tends to be weak or moderate. More importantly, the correlation was only significant on students from certain medical school, not on all four medical schools. This situation was similar when we analyzed the correlation of national admission test scores with clinical year GPA and UKDI score. A study was done earlier in an Indonesian medical faculty in 2010 and it also found that there were no correlation between student's score in university entrance test and the medical education GPA (Suswati I, 2010). Evans P and Wen FK(2007) reported that Medical College Admission Test (MCAT) subscores were less predictive to osteopathic medical student academic performance in Oklahoma State University - College of Osteopathic Medicine. Wilkinson *et al* (2008) also found that medical school's selection criteria only modestly predict academic performance.

The admission test scores may not play an important role in the medical school output and outcome. Although it is the standardized university admission test across the country, the use of admission test scores in the selection system as a part of CBC implementation in medical education may require evaluation. Admission test into medical school probably should not be based solely on preliminary knowledge obtained during high school.

As all medical schools in this study were accredited as "A", we argued that the medical education *process* occurred in each school would not confound the correlation between input and output. Having the same "A" accreditation status shows that these medical schools were similarly very good regarding learning content (including human resources), learning methods and strategies, and educational environment (including facilities). These factors are part of the requirements for medical school accreditation (BAN-PT, 2014).

One important finding of this study is the positive moderate correlation between Preclinical Year GPA with UKDI score. Although the correlation was moderate, it was consistent across four medical schools, compared to the correlation between national admission test score and clinical year GPA with UKDI score. This finding concurs with the existing literatures that acknowledge strong correlation between undergraduate GPA scores with the whole performance of student in medical school (Evans P, Wen FK, 2007; Wilkinson *et al.*, 2008).Our findings confirmed a study in Indonesia by Salvandega *et al* (2011) that the preclinical year GPA scores was a better UKDI scores predictor compared to clinical year GPA.

Figure 2 shows difference in correlation pattern when our study analyzed the correlation between Preclinical year GPA and UKDI score separately per medical school and when it was analyzed in total. The consistency of significant correlation was not seen when all data from four medical schools were combined. This is likely because they were resulted from different medical schools.

Correlation between Preclinical Year GPA with UKDI score was possible, particularly related to the type of UKDI score used by our study i.e. UKDI-CBT. National admission test score only shows medical students' preliminary knowledge of basic science they learnt during high school. Entering preclinical year, medical students learn specifically medical knowledge and skills. In the clinical year, skill of a medical student is more assessed. Since UKDI-CBT contains exclusively medical knowledge questions, it is possible that preclinical year GPA will influence the UKDI-CBT result more than the admission test scores or clinical year GPA.

The findings of the present study have several limitations. First, the dataset consists of academic records from four medical schools, thus the ability to generalize the result across all public universities is limited, let alone private universities. Second, this study design is subject to information bias since investigators could not control the accuracy of primary data collection and the reliability of administrator of all medical schools who were responsible

to deliver the data. Third, the analysis did not control any possible confounding factors.
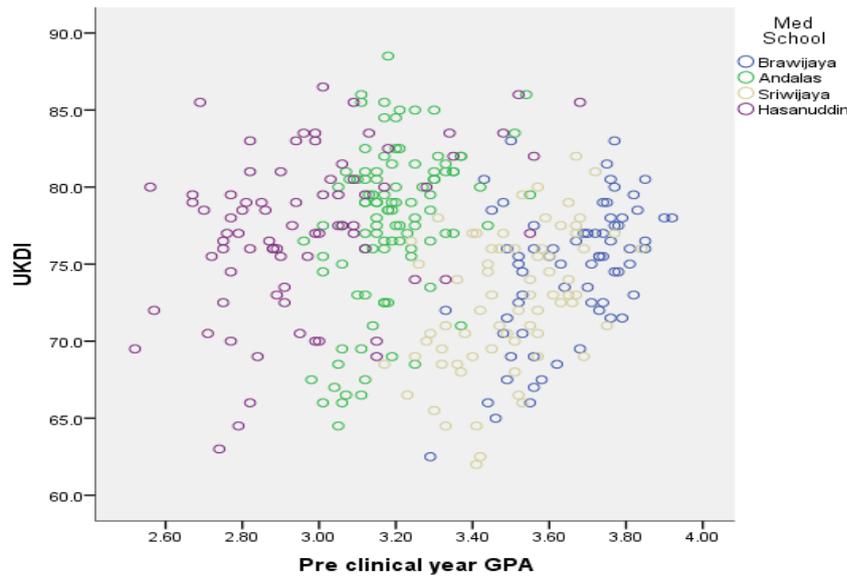

Figure 2. Scatterplot graph of correlation between Preclinical Year GPA and UKDI score

5. Conclusions

Our study found significant correlation between national admission test scores and preclinical and clinical GPAs, after adjusting for medical school accreditation, with the strength of correlations ranged from weak to moderate. We also found significant but weak correlation between national admission test scores and UKDI score. However, these findings were not consistent on all medical schools. On the other hand, correlation between preclinical year GPA and UKDI score was found significant on all medical schools, and the strength of the correlation was moderate. The national admission test scores may not determine the whole performance of medical students during preclinical and clinical year and ultimately their medical competency.

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