

Comparisons of the predictive values of admission criteria for academic achievement among undergraduate students of health and non-health science professions: a longitudinal cohort study

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Objective: The main objective of this study was to compare the predictive value of admission criteria for students' grade point averages (GPAs) over a 3-year period for a cohort of students enrolled in health and non-health science professions during the 2012–2013 academic year at Imam Abdulrahman Bin Faisal University (IAU).

Materials and methods: This longitudinal, retrospective cohort study was conducted at eight colleges (four health and four non-health colleges) in IAU between December 2017 and February 2018. The high school grades, aptitude test scores, achievement test scores, and GPA scores over a 3-year period for students admitted during the 2012–2013 academic year at health and non-health colleges at IAU were used. The data were analyzed using descriptive and inferential statistics.

Results: Positive, significant correlations ($P < 0.01$) were found between the three admission criteria and the annual GPA scores (r ranged from 0.192 to 0.499 and from 0.359 to 0.588) for both the health and non-health colleges. High school grades were the most significant predictor of annual GPAs ($\beta = 0.340$, $P < 0.01$ and $\beta = 0.374$, $P < 0.01$), followed by achievement test scores in both health and non-health fields of study, respectively. Aptitude test scores were not good predictors of GPAs for the health and non-health colleges.

Conclusion: High school grades are the most important predictor of student GPAs at health and non-health colleges. Changing the weighting criteria in our institution to place more emphasis on high school grades, as our findings indicate, should be considered during the admission process.

Keywords: academic achievement, admission criteria, health and non-health professions, aptitude test, achievement test, predictors of grade point average score

Introduction

Motivation for selecting a particular profession is a multifaceted issue.¹ Many factors may contribute to formalizing an individual's decision regarding a future career choice. Among these factors are social status, job security, high income, and flexible working hours.^{1–3} According to Idris,⁴ status and position are the main motivational factors for Saudi people choosing their careers. One key strategy for actualizing one's desires is to pursue undergraduate studies.

According to the data from the Central Department of Statistics and Information, Saudi enrollment at the bachelor's level has increased from 82,075 students in

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1999/2000 (31,524 male and 50,551 female students) to 339,836 in 2013/2014 (176,332 male and 163,504 female students).⁵ Such a situation generates high competition among students for admission. Therefore, the Ministry of Higher Education in Saudi Arabia has adopted a new policy for the screening of students for admission to universities; this policy relies on three criteria: high school grades, the Saudi National Aptitude Exam (SAT1), and the Saudi National Achievement Exam (SAT2). A brief explanation of the elements of these tests is as follows: In Saudi Arabia there are 12 years of free general education (6 years of primary, 3 years of intermediate, and 3 year of high school education). High school has two divisions, Scientific and Theoretic. In both divisions, students are required to study general courses such as Arabic and English languages, religious studies, and computer and information technology. Specific science courses are taught for Scientific division such as chemistry, biology, physics, geology, and mathematics, while Theoretic division focused on theoretical courses such as Arabic studies (eg, literature, reading and linguistic communication, rhetoric and criticism, and grammar) and social and national studies. The final high school grade is based on the cumulative scores of first and second semesters.

SAT1 intends to measure the students' general abilities such as reading comprehension, logical relations, problem-solving behavior, inferential, and induction. It includes two sections: 1) verbal section, consists of five parts: analogy, odd one out, contextual text error, sentence completion, and reading comprehension. 2) Quantitative section, consists of four parts: arithmetic, algebra, geometry, and interpretation of graphs and tables. The test consists of 120 multiple-choice questions, where 68 of these questions are verbal and 52 are quantitative. It is meant for high school graduates or students at either the second- (Grade 11) or third- (Grade 12) year in high school of Scientific and Theoretic divisions. The total number of opportunities given to each student for taking this test is five attempts.

The SAT2 covers the concepts in mathematics, biology, English, physics and chemistry, that are taught in the high schools in Saudi Arabia. It includes five sections: chemistry, mathematics, biology, English, and physics. Twenty percentage is allocated for each section. The test is for high school graduates or students at the second term of their third grade in high school of Scientific divisions. The total number of opportunities given to each student for taking this test is two attempts. In both SAT1 and SAT2 exams, only the best scores of the five and two attempts, respectively, are reported to university admissions' committees.^{6,7}

Both the SAT1 and SAT2 exams are prepared, administered, and scored by the Ministry of Higher Education. The weights allocated to these criteria vary among the universities. For Imam Abdulrahman Bin Faisal University (IAU), the weights allocated for these criteria are 30%, 30%, and 40%, respectively.

It has been highlighted in the literature that the predictive validity of admission tests for universities is still a matter of debate and controversy.⁸ For instance, in King Saud University, Saudi Arabia, a study has been conducted using regression technique to investigate if the pre-university exams such as high school grade point average (GPA), aptitude test, and achievement test have a significant effect on students' college GPAs. They have found that high school GPA effects the college GPA more than pre-university exam.⁹ An earlier study performed by Al-Rukban et al¹⁰ reported that the achievement test was the most significant predictive factor of students' college GPA, while the high school grade was not statistically significant. Another noteworthy study conducted by Murshid¹¹ to assess the reliability of admission criteria for predicting students' academic performance, found that high school grade and achievement test are good predictors of college GPA.

Although literature focused on predictive validity of admission criteria, mainly, in the health profession settings, there is a gap in literature with respect to non-health profession settings. To the authors' knowledge, no previous study has been conducted formally in IAU to compare the issue of predictive validity of admission criteria in health and non-health profession settings.

The main objective of this study is to compare the predictive value of admission criteria for students' GPAs over a 3-year period for all students enrolled in health and non-health science professions during the 2012–2013 academic year.

It is hoped that the results of this study will contribute to supporting the theoretical basis for research on the predictive value of admission criteria in universities. Additionally, this study will contribute to identifying the predictive value of the admission criteria used by IAU and the extent to which they contribute to the academic success of accepted students. The study will also help to identify the most important criteria on which a decision to accept or reject a student is based.

Materials and methods

This longitudinal, retrospective cohort study was conducted in IAU, Saudi Arabia between December 2017 and February 2018. All records for students admitted to IAU during the

2012–2013 academic year were used in this study. Records for a total of 1,122 students, involving eight cohorts of students enrolled in four health colleges (namely, medicine, applied medical sciences, dentistry, and clinical pharmacy) and four non-health colleges (namely, engineering, business, and architecture and planning design) from the 2013–2014 to 2015–2016 academic years, were involved in the present study. Simple random sampling was performed to select these colleges. The collected data include students' high school GPA (SGPA), the SAT1 scores, the SAT2 scores, and the students' annual GPAs (a 5.0 scale) for the 2013–2014 (GPA-2013–2014), 2014–2015 (GPA-2014–2015), and 2015–2016 (GPA-2015–2016) academic years. Student data was anonymized and, therefore, would not require their consent to review. SPSS (IBM, Chicago, IL, USA) version 20 was used for the data analysis. A quantitative analysis by descriptive statistics was performed; the data were presented via frequency distribution. Inferential statistics were performed by independent *t* tests. A Pearson correlation and a regression analysis were conducted to test for relationships among the variables. The annual GPA at the end of the fourth year, 2015–2016, was used as the dependent variable, while the independent variables were the high school grades, the SAT1 scores, and the SAT2 scores. A *P*-value of less than 0.05 was considered significant. Data were obtained from the academic electronic database at IAU through the Deanship of Admission and Registration. Ethical approval and permission to access these data were secured from the Institutional Review Board (IRB-2018-03-035) of IAU.

Results

Out of 1,122 student records, 246 (22%) contained incomplete information or the students were on leave and/or had withdrawn from the university. This yields a response rate of 78%. Table 1 shows the distribution of the 876 students according to their colleges and genders.

Table 2 shows the descriptive statistics for admissions and annual GPA scores (the annual GPA score is the average of the first and second semesters) for each profession. The mean

scores for the SAT1 and SAT2 for the health professions were higher than those for the non-health professions. There were slight decreasing trends in the GPAs across the 3 years for students in all the professions. As students proceed through their studies, their GPAs decrease slightly.

Table 3 shows the correlation matrix among the three preadmission tools and annual GPA scores across the 3 years for the whole sample. There were significant positive relationships ($P < 0.01$) between the admission test scores and GPAs across the 3 years. In this analysis, all students were combined, adjusting for the field of study. The results show that there was a slight decrease in the strength of the correlation between the admission tools and the annual GPAs across the years. Table 3 also shows that the correlation value between the SAT1 and SAT2 was the highest ($r = 0.706$) compared to the correlations of the other admission tools. The correlation results among the three admission tools were positive and statistically significant ($P < 0.01$).

Table 4 shows the comparison results of the admission criteria and GPAs between the health and non-health students across the 3 years. There were significant differences in the mean scores of the admission tools and GPAs between the health and non-health professions. The mean scores of the admission tools and GPAs of the health professions were significantly higher than those of the non-health professions.

Table 5 shows the analysis of the correlations between the admission criteria (high school grades, SAT1, and SAT2) and the annual GPA scores-2013–2016 at the end of the fourth year for both the health and non-health colleges. There were significant positive correlations between GPAs across the 3 years and for all admission scores for both the health and non-health colleges. Notably, the magnitude of the correlation coefficients among all three admission criteria and GPA scores across the 3-year study was higher for the non-health colleges than for the health colleges. However, all the correlation scores decreased slightly as students progressed through their years of study in both fields of study.

Table 5 also shows the results of the linear regression analysis. In this analysis, the annual GPAs at the end of the

Table 1 Distribution of study samples among health and non-health colleges

	Clinical pharmacy n (%)	Applied medical sciences n (%)	Dentistry n (%)	Medicine n (%)	Architecture & planning n (%)	Business administration n (%)	Design n (%)	Engineering n (%)	Total n (%)
Male	11 (2.7)	42 (10.1)	35 (8.4)	124 (29.9)	116 (28.0)	47 (11.3)	0	40 (9.6)	415 (100)
Female	21 (4.6)	109 (23.6)	28 (6.1)	114 (24.7)	0	108 (23.4)	54 (11.7)	27 (5.9)	461 (100)
Total	32 (3.7)	151 (17.2)	63 (7.2)	238 (27.2)	116 (13.2)	155 (17.7)	54 (6.2)	67 (7.6)	876 (100)

Table 2 Descriptive statistics for admissions criteria and student GPAs for each profession

	Health colleges					Non-health colleges				
	Clinical pharmacy M (SD)	Applied medical sciences M (SD)	Dentistry M (SD)	Medicine M (SD)	Architecture & planning M (SD)	Business administration M (SD)	Design M (SD)	Engineering M (SD)		
SGPA	98.196 (2.108)	98.433 (1.890)	98.722 (1.475)	98.953 (1.456)	93.122 (3.615)	96.007 (3.959)	98.587 (1.402)	97.304 (3.435)		
SAT1	85.656 (5.264)	84.463 (4.803)	86.603 (4.140)	88.600 (5.002)	75.948 (5.171)	80.503 (5.690)	83.759 (4.898)	83.029 (6.232)		
SAT2	89.093 (5.101)	86.609 (5.425)	87.381 (5.377)	90.449 (5.626)	72.689 (6.071)	78.600 (7.684)	84.666 (4.576)	82.492 (7.861)		
GPA-2013–2014	4.484 (0.307)	4.232 (0.292)	4.123 (0.522)	4.558 (0.418)	3.488 (0.542)	3.856 (0.692)	4.319 (0.466)	3.876 (0.719)		
GPA-2014–2015	4.342 (0.436)	4.176 (0.346)	4.005 (0.517)	4.370 (0.502)	3.485 (0.526)	3.835 (0.715)	4.312 (0.481)	3.812 (0.751)		
GPA-2015–2016	4.226 (0.532)	4.175 (0.356)	3.976 (0.488)	4.320 (0.512)	3.510 (0.535)	3.846 (0.719)	4.295 (0.494)	3.811 (0.786)		

Abbreviations: M, mean; SAT1, Saudi National Aptitude Exam; SAT2, Saudi National Achievement Exam; SGPA, secondary grade point average.

fourth year 2015–2016 were used as the dependent variable, while the independent variables were the high school grades, the SAT1 scores, and the SAT2 scores. For the health colleges, the table reveals that the three independent variables account for 26.9% of the variance in the annual GPA at the end of the fourth year. The highest significant predictor of GPA is high school grades ($\beta=0.340$, $P<0.01$), followed by SAT2 score ($\beta=0.292$, $P<0.01$). On the other hand, the three admission criteria for the non-health colleges accounted for 35.1% of the variance. High school grades were the most important predictor ($\beta=0.374$, $P<0.01$), followed by the SAT2 score ($\beta=0.310$, $P<0.01$).

Discussion

The current study aimed to compare the predictive value of the admission criteria for students' GPAs over a 3-year period for a cohort of students enrolled in health science and non-health science professions during the 2012–2013 academic year at IAU. The main findings revealed that there were statistically significant positive associations between the admission test scores and GPA scores across the 3 years for both fields of study (ie, health and non-health) and for the combined colleges. This finding agreed with the results of Alhadlaq et al,¹² Albishri et al¹³ and Al-Alwan,¹⁴ which found positive significant correlations between academic performance and preadmission test scores.

This study showed that there were significant positive correlations among all the admission criteria, but the highest correlation was found between the SAT1 and SAT2. This finding is consistent with the finding of Al-Alwan et al¹⁵ who found the highest correlation between the SAT1 and SAT2 compared with other admission tests. However, our result contradicted the findings of Murshid,¹¹ who found no significant relation between the SAT1 and college GPAs.

In this study, the results indicated that there were significant positive correlations between GPAs across the 3 years and all admission scores for both the health and non-health colleges. Notably, the magnitude of the correlation coefficients among all three admission criteria and GPA scores across the 3 years of study was higher in the non-health colleges than the health colleges. However, all the correlation scores decreased slightly as students progressed through their years of study in both fields of study.

The presence of a positive significant association between the SAT1 and GPA contradicts the finding of Murshid,¹¹ who found no significant relationship between the two in medical school.

Table 3 Intercorrelation matrix among the three preadmission tools and GPA scores across the 3 years for the whole sample

	SGPA	SAT1	SAT2	GPA-2013–2014	GPA-2014–2015	GPA-2015–2016
SGPA	–					
SAT1	0.490**	–				
SAT2	0.605**	0.706**	–			
GPA-2013–2014	0.644**	0.507**	0.657**	–		
GPA-2014–2015	0.603**	0.441**	0.597**	0.968**	–	
GPA-2015–2016	0.572**	0.406**	0.557**	0.937**	0.990**	–

Note: **, correlation is significant at the 0.01 level (two-tailed).

Abbreviations: SAT1, Saudi National Aptitude Exam; SAT2, Saudi National Achievement Exam; SGPA, secondary grade point average.

Table 4 Comparison of preadmission criteria and GPA scores between health and non-health students across the 3 years

	Health colleges, n=484			Non-health colleges, n=392			P-value
	Min	Max	Mean (SD)	Min	Max	Mean (SD)	
SGPA	89.61	100.00	98.711 (1.668)	80.14	100.00	95.730 (3.985)	P<0.01
SAT1	72.00	99.00	86.855 (5.178)	65.00	99.00	80.035 (6.238)	P<0.01
SAT2	63.00	100.00	88.762 (5.759)	59.00	98.00	78.352 (8.083)	P<0.01
GPA-2013–2014	2.381	5.000	4.395 (0.430)	2.076	4.961	3.814 (0.678)	P<0.01
GPA-2014–2015	2.416	4.995	4.260 (0.474)	1.895	4.949	3.793 (0.689)	P<0.01
GPA-2015–2016	2.458	4.966	4.224 (0.479)	1.845	4.952	3.803 (0.696)	P<0.01

Abbreviations: Max, maximum; Min, minimum; SAT1, Saudi National Aptitude Exam; SAT2, Saudi National Achievement Exam; SGPA, secondary grade point average.

The results of the regression analysis showed that the most important predictor for GPA is high school grades, followed by SAT2 scores for both health and non-health colleges. The results of this study agree with Murshid's¹¹ findings, which indicated that both high school grades and SAT2 scores are good predictors of GPA. However, in this study, it seems that SAT1 scores are not significant predictors of annual GPAs for students at health and non-health colleges. This result is consistent with that of Murshid,¹¹ who found that the SAT1 score was not a good predictor of medical students' GPAs.

Albishri et al¹³ found that 20.8% of the variability in medical students' GPAs was explained by multiple preadmission criteria, mainly high school grades, SAT2, SAT1, and English grades in high school. While Murshid¹¹ found that high school grades, SAT1 scores, and SAT2 scores accounted for 19.9% of the variance in the medical students' GPAs. In the present study, high school grades, SAT2 scores, and SAT1 scores accounted for 26.9% of the variance in the GPAs of students in health professions.

Although three admission criteria were used to select the students admitted to IAU, high school grades were found to be the most important predictor of students' annual GPA at the end of their fourth year in the health and non-health colleges. This result sheds light on the importance of considering changing the weighting criteria in our institution to place more emphasis on high school grades as our findings indicate.

The findings of the present study shall have some implications. First, it might help decision makers at university level identify whether current admission criteria are valid predictors of academic achievement of undergraduate students. Second, the findings might serve as a basis for continuous revision of the weights allocated for the admission test for future admission plans.

Limitation

The main limitation of the present study is that it focused primarily on the undergraduate admission to the governmental university sector. Other sectors such as private universities may use different admission processes. Thus, caution should be taken when generalizing the results to other academic sectors.

Conclusion

Based on the findings of this study, it can be concluded that not all the admission criteria used for student selection are good predictors of students' academic achievement in IAU. High school grades are the most important predictor of students' GPAs at the health and non-health colleges. Decision makers at the Deanship of Admission and Registration should consider changing the weighting criteria in IAU to place more emphasis on high school grades as the findings indicate.

Table 5 Comparison of the Pearson correlations and linear regression analysis between the health and non-health colleges

	Health colleges, n=484					Non-health colleges, n=392				
	GPA-2013-2014	GPA-2014-2015	GPA-2015-2016	SE (t)	β (P)	GPA-2013-2014	GPA-2014-2015	GPA-2015-2016	SE (t)	β (P)
SGPA	0.470**	0.457**	0.453**	0.012 (8.021)	0.340 (0.000)	0.588**	0.568**	0.534**	0.008 (7.753)	0.374 (0.000)
SAT1	0.311**	0.225**	0.192**	0.004 (-0.307)	-0.014 (0.759)	0.389**	0.378**	0.359**	0.006 (0.022)	0.001 (0.982)
SAT2	0.499**	0.447**	0.419**	0.004 (5.956)	0.292 (0.000)	0.557**	0.537**	0.503**	0.005 (5.584)	0.310 (0.000)
Adjusted R ²	0.269					0.351				

Note: **Correlation is significant at the 0.01 level (two-tailed).

Abbreviations: SAT1, Saudi National Aptitude Exam; SAT2, Saudi National Achievement Exam; SGPA, secondary grade point average.

Author contributions

Both authors contributed to conception and design, acquisition of data, analysis and interpretation of data, drafting the article, and approved the final version of the article for the publication. Both authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Disclosure

The authors report no conflicts of interest in this work.

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