

# Ability of Admissions Criteria to Predict Early Academic Performance Among Students of Health Science Colleges at King Saud University, Saudi Arabia

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**Abstract:** The aim of this study was to evaluate the ability of admissions criteria at King Saud University (KSU), Riyadh, Saudi Arabia, to predict students' early academic performance at three health science colleges (medicine, dentistry, and pharmacy). A retrospective cohort study was conducted with data from the records of students enrolled in the three colleges from the 2008-09 to 2010-11 academic years. The admissions criteria—high school grade average (HSGA), aptitude test (APT) score, and achievement test (ACT) score—were the independent variables. The dependent variable was the average of students' first- and second-year grade point average (GPA). The results showed that the ACT was a better predictor of the students' early academic performance than the HSGA ( $\beta=0.368$ ,  $\beta=0.254$ , respectively). No significant relationship was found between the APT and students' early academic performance ( $\beta=-0.019$ ,  $p>0.01$ ). The ACT was most predictive for pharmacy students ( $\beta=0.405$ ), followed by dental students ( $\beta=0.392$ ) and medical students ( $\beta=0.195$ ). Overall, the current admissions criteria explained only 25.5% of the variance in the students' early academic performance. While the ACT and HSGA were found to be predictive of students' early academic performance in health colleges at KSU, the APT was not a strong predictor. Since the combined current admissions criteria for the health science colleges at KSU were weak predictors of the variance in early academic performance, it may be necessary to consider noncognitive evaluation methods during the admission process.

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Health care professionals are considered privileged in most societies, making health care a popular career choice for students. In Saudi Arabia, enrollment in health science colleges has increased significantly throughout the last decade. For example, the number of enrolled students in health science colleges at public universities in Saudi Arabia increased from 2,712 students in 2001 to 17,475 students in 2011.<sup>1</sup> With the increase in competition for a limited number of available positions, reliable and fair admissions criteria are needed to differentiate among applicants based on the predictability of their future success.<sup>2</sup>

Globally, admission to health professions programs varies among countries and within each country based on discipline (e.g., medicine, dentistry,

pharmacy).<sup>3</sup> For all, however, admission tests are usually administered to assess students' cognitive and noncognitive skills to predict their likely performance and academic success.<sup>4</sup> In the United States, education in medicine, dentistry, and pharmacy are at the post-college level; students must complete two to four years of undergraduate studies in science or related fields before applying to these programs.<sup>5-7</sup> Requirements for admission usually include acceptable academic performance indicated by a minimum undergraduate grade point average (GPA) and a minimum score on a standardized computer-based test, such as the Medical College Admission Test (MCAT), Dental Admission Test (DAT), or Pharmacy College Admission Test (PCAT).<sup>5-7</sup> These tests are designed to measure general academic ability, com-

prehension of scientific information, and perceptual ability of the applicant.<sup>8-10</sup> A recent national cohort study of 119 medical schools in the United States determined that total MCAT score predicted students' progress more than their undergraduate GPA.<sup>11</sup> Other studies have found positive correlations between DAT and PCAT scores and students' academic success in the first two years in dentistry and pharmacy colleges, respectively.<sup>12-16</sup>

In contrast to the admissions system in the United States, students can apply to health colleges directly after their secondary education in the United Kingdom.<sup>3</sup> In 2006, the United Kingdom Clinical Aptitude Test (UKCAT) was developed in collaboration with 23 medical schools and eight dental schools.<sup>17</sup> The UKCAT is a set of cognitive tests taken before application to medical and dental schools in the United Kingdom.<sup>18</sup> A study at Newcastle University found that UKCAT scores were predictive of students' first- and second-year examination scores at medical school.<sup>19</sup> Other studies have concluded that the predictive value of the UKCAT in relation to early academic performance based on examination scores in medical colleges is low.<sup>17,20</sup>

In the past, admission to health colleges in Saudi Arabia was based solely on academic performance (i.e., high school grades). It was not until the early 2000s that the Ministry of Higher Education in Saudi Arabia took steps to develop standard written tests necessary for application to universities.<sup>21</sup> Today, three major elements comprise the required admissions criteria to all governmental health colleges in Saudi Arabia: the high school grade average (HSGA), aptitude test (APT) score, and achievement test (ACT) score. The weight percentage of each element varies by university. The APT is a standardized test intended to measure students' analytical and deductive skills in verbal and quantitative sections, while the ACT is a standardized test to measure comprehension, application, and inference in biology, chemistry, physics, mathematics, and English.<sup>22</sup>

Today, at King Saud University (KSU), admission into the health colleges is based on a combined formula that consists of three elements: HSGA (30%), APT (30%), and ACT (40%). Each year, a large number of students graduating from high school compete for a set number of academic seats based on their total score calculated by this combined formula. In addition, KSU requires a personal interview with students who are initially admitted based on their formula score to assess personal characteristics required for any health professional. However, the cur-

rent role of the personal interview at KSU is only to exclude students presenting with certain attitudes or personal traits considered unacceptable in the health professions rather than having a weight or value in the admissions score. The study system for health colleges at KSU is based on one preparatory year, four to five years of specialized curriculum study, and one year of obligatory training. Admission to each college after the preparatory year is currently based on the students' preference, preparatory year GPA, and number of available positions.

Among the few studies that have investigated the relationship between admissions criteria and university GPA in Saudi Arabia, most of them were directed toward medical school students only.<sup>23-26</sup> The aim of our study was to evaluate the ability of current admissions criteria at KSU to predict students' early performance in the first two years of their specialized curriculum study in three health colleges (medicine, dentistry, and pharmacy).

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## Materials and Methods

The study was conducted at KSU, a governmental university in Riyadh, Kingdom of Saudi Arabia. The study proposal was approved by the research ethical committee of the College of Dentistry Research Center (registration number IR0081). Records for a total of 1,695 male and female students, consisting of three cohorts of students enrolled in three health colleges (medicine, dentistry, and pharmacy) from the 2008-09 to 2010-11 academic years, were included in the study.

For each student, the following parameters were collected and recorded: HSGA score, APT score, ACT score, and first- and second-year (post-preparatory year) annual GPA. All required data were obtained from the academic electronic database at KSU through the office of the dean of admission and registration. The independent variables considered in this study were HSGA, APT, and ACT. The dependent variable was the students' early in-college performance, which is described as the average of a student's first- and second-year annual GPA in his or her health college. The GPA at KSU is based on a 5.00 scale.

The data were analyzed using the statistical package for the social sciences software (SPSS Inc., Chicago, IL, USA). Descriptive analysis was carried out by calculating the mean and standard deviation for all variables in each group. The Pearson correla-

tion coefficient was used to describe the correlation between the admissions variables and the dependent variable (p-value was considered statistically significant at  $p < 0.01$ ). The nature and strength of the relationship between the admissions variables and the dependent variable were assessed by using multivariate linear regression analysis.

## Results

The distribution of students among the three health colleges is shown in Table 1. The sample consisted of 955 (56.3%) male students and 740 (43.7%) female students. The mean and standard deviation for all three variables, as well as the cumulative totals (the compilation of medicine/dentistry/pharmacy school group results), are shown in Table 2. A statistically significant positive relationship was found between all admissions criteria and the students' performance ( $p < 0.01$ ) when the scores of each variable were combined for the medicine/dentistry/pharmacy school groups (cumulative total) (Table

3). The APT had the weakest correlation coefficient value ( $r = 0.110$ ), followed by HSGA ( $r = 0.349$ ) and ACT ( $r = 0.443$ ).

Regression analysis indicated that only the ACT and HSGA were statistically predictive of students' early performance ( $p < 0.01$ ) (Table 4). However, the ACT was found to be a better predictor than the HSGA ( $\beta = 0.368$  and  $\beta = 0.254$ , respectively). A multivariate regression model indicated that all three admissions criteria combined could account for approximately 25.5% of the variance in students' first- and second-year GPA. The variation in students' early performance could be explained by all three admissions criteria combined in 31.1% of the cases for pharmacy, 23.4% for dentistry, and only 7.5% for medicine.

When comparing the predictive ability of achievement tests on students' early performance among the three health colleges, we determined that achievement tests were most predictive for pharmacy students ( $\beta = 0.405$ ), followed by dental students ( $\beta = 0.392$ ), and finally medical students ( $\beta = 0.195$ ). Table 4 shows the results of the multivariate regres-

**Table 1. Study sample distribution among health professions colleges at King Saud University**

Factor	Medicine	Dentistry	Pharmacy	Total
Number of students	766	315	614	1,695
Percentage of total	45.2%	18.6%	36.2%	100%

**Table 2. Descriptive statistics for admissions criteria and student performance variables for each health professions college and all three combined**

Admissions Criterion	Medicine Mean±SD	Dentistry Mean±SD	Pharmacy Mean±SD	Total Mean±SD
High school grade point average	98.84±1.60	98.53±1.76	97.91±2.09	98.38±2.01
Aptitude test grade	84.49±5.45	82.83±5.17	80.95±5.53	82.82±6.06
Achievement test grade	84.46±6.55	81.90±7.44	79.26±7.10	82.11±7.30
Early-performance grade point average	4.22±0.72	3.84±0.88	3.52±0.95	3.90±0.90

**Table 3. Correlation between admissions variables and students' early performance in each health professions college and for all three combined**

Variable	Medicine r	Dentistry r	Pharmacy r	Total r
High school grade point average	0.199*	0.321*	0.379*	0.349*
Achievement test	0.208*	0.439*	0.484*	0.443*
Aptitude test	-0.012	0.109	0.008	0.110*

r(Pearson correlation coefficient)

\*Correlation is statistically significant at  $p < 0.01$ .

**Table 4. Multivariate regression of admissions criteria for predicting students' early performance in each health professions college and for all three combined**

Variable	Medicine $\beta$	Dentistry $\beta$	Pharmacy $\beta$	Total $\beta$
High school grade point average	0.165*	0.209*	0.285*	0.254*
Achievement test	0.195*	0.392*	0.405*	0.368*
Aptitude test	-0.077	-0.055	-0.031	-0.019

$\beta$  (standardized coefficient) is the ability of admission variables to predict early performance.

\*Relationship is statistically significant at  $p < 0.01$ .

sion model for predicting students' early performance with a comparison based on colleges.

## Discussion

Admissions criteria to health colleges in Saudi Arabia are mainly based on the HSGA, APT, and ACT. Studies have been conducted to assess the correlation of these admissions criteria with students' academic performance in Saudi medical colleges.<sup>23-26</sup> In general, there is consistent evidence that a significant positive correlation exists between all admission variables and university GPA. However, the ACT was determined to be the most predictive, followed by the HSGA and lastly the APT.<sup>23-25</sup> The weakest predictor, the APT, concentrates on evaluating students' ability to learn in general regardless of any specific skill in a particular topic.<sup>22</sup> For example, the APT measures abilities relevant to reading comprehension, recognizing logical relations, and solving problems based on basic mathematical notions.<sup>22</sup>

Our study found that the ACT and HSGA were statistically predictive of students' early academic performance in their respective colleges based on their GPA. Thus, students who scored high on the HSGA and ACT were most likely to have a higher GPA while studying in their college. This finding is consistent with the conclusion of similar studies performed with students of medical colleges in Saudi Arabia, which demonstrated that the ACT was the most important predictor of early academic performance.<sup>23-25</sup> On the contrary, only one study concluded that the HSGA was the most predictive variable.<sup>26</sup> Nonetheless, it is imperative to state that, to our knowledge, all published related studies performed in Saudi Arabia have been confined to medical colleges; no available literature has been found to assess the relationship between admissions criteria and academic performance for students of dental or pharmacy colleges in Saudi Arabia.

The selection process of students to be admitted is usually based on the cognitive and noncognitive achievement of applicants.<sup>4</sup> Cognitive achievements are typically based on past academic accomplishments, while noncognitive achievements are based on qualities beyond cognitive skills.<sup>27</sup> The cognitive aspect is mostly evaluated by pre-admission performance, e.g., the HSGA, or a written test such as the APT and ACT.<sup>24</sup> The importance of cognitive criteria evaluation has been demonstrated in studies that investigated the predictability of students' performance in colleges.<sup>9-11,14,23-26,28,29</sup> In addition, other cognitive achievements are frequently evaluated for other purposes, e.g., scoring in licensing examinations and professional careers.<sup>30</sup> Our findings revealed that the cognitive nature of the admissions criteria currently used at KSU can only explain approximately 25.5% of the variance in students' GPA during their first and second years of study in their respective health colleges. However, this implies that the majority of the variation in academic performance of students in this study cannot be accounted for by the currently employed cognitive admissions criteria. This variation can presumably be a consequence of personal qualities, teaching strategies, and other noncognitive factors.<sup>3</sup> Although a personal interview with students is conducted at KSU, the value of the interview remains limited to exclusion of students with obvious difficulties to become successful health care providers. No true assessment of noncognitive characteristics is performed, and no weight is given to the interview in the admission process.

Several methods have been reported to facilitate the assessment of noncognitive qualities of applicants, such as interviews and group exercises,<sup>31</sup> multiple mini-interviews,<sup>32,33</sup> and simulated tutorials.<sup>34</sup> A survey of 22 medical schools in the United Kingdom found that 20 schools used some noncognitive criteria for admission to assess applicants' personality demonstrated by their motivation

for medicine, extracurricular interests, teamwork experience, and leadership skills.<sup>3</sup> Thus, perhaps new evaluation modalities of a noncognitive nature need to be considered at KSU to improve the predictability of students' academic potential due to the low predictability of the currently employed cognitive admissions criteria. Improving the quality of admissions criteria, especially to health science colleges, will not only increase the predictability of program completion but can also lead to more successful future health care practitioners with greater commitment toward patient care.<sup>2</sup>

This study focused on correlating admissions criteria to students' early performance up to their second year of specialized study in their respective health colleges. Thus, the results of this study do not reflect the association between admissions criteria and students' full academic performance throughout the college years and may be considered a limitation of this study. Since the study was limited to one university, our findings may not be generalizable to other universities in Saudi Arabia or elsewhere.

## Conclusion

The results of this study suggest that although the ACT and HSGA were predictive of these students' early academic performance in health colleges at KSU, the APT was not a strong predictor. Inclusion of all three admissions criteria accounted for approximately 25.5% of the variance in the students' first- and second-year GPAs. Serious consideration should be given to including noncognitive criteria for admission to health science colleges at KSU to improve the predictability of students' academic potential, especially in view of the low predictability of the currently employed cognitive admissions criteria.

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