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Differences in predictors of academic success using multi- and individual year student admissions data

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Abstract

Introduction: Schools of pharmacy continually focus on improving methods used to admit successful students. This study evaluated multi-year and individual year admissions data to assess predictors of student success.

Methods: Three years of student admissions data were compared to selected student outcomes to identify predictors of student success. Pearson correlation coefficients and regression analyses were used.

Results: Data of 417 students were evaluated. Pre-pharmacy cumulative and science grade point averages (GPA) were the strongest predictors of final pharmacy cumulative (FPC) GPA and individual grades in science and therapeutic courses for all multi-year and individual class analyses (r=0.41-0.55, p<0.001). The Pharmacy College Admissions Test composite and chemistry scores correlated with FPC GPA and course grades for all analyses (r=0.19-0.49, p<0.05). Predictors of passing the North American Pharmacy Licensure Exam varied. Correlations differed when evaluating multi-year and individual year data.

Conclusion: Schools should conduct both multi-year and individual year analyses to determine predictors of academic success.

Keywords: *Academic Performance, Admission, Grades, Pharmacy School, Predictors, Student Pharmacists*

Introduction

Schools of pharmacy continually focus on improving methods used to admit students who will be successful in their academic programmes. As curriculum standards change, programmes may question previously identified predictors of student success such as Pharmacy College Admissions Test (PCAT) scores and undergraduate grade point averages (GPA). The American Association of Colleges of Pharmacy (AACP) Special Committee on Admissions recommends that schools assess applicant characteristics to determine predictors of success in their curricula (Wall *et al*., 2015). Reports of student pharmacists' predictors of success have assessed multi-year data (Kidd & Latif, 2003; Houglum *et al*., 2005; McCall *et al*., 2006; McCall *et al*., 2007; Unni *et al*., 2011; Allen & Diaz, 2013; Schauner *et al*., 2013; Heldenbrand *et al*., 2016; Tejada *et al*., 2016). The medical, nursing, and physician assistant professions have also determined predictors of success and used pooled data collected over multiple years (Wolkowitz & Kelley, 2010; Timer & Clauson, 2011; Kruzicevic *et al*., 2012; Andreeff, 2014). When evaluating their data, the authors questioned consistency of predictors between classes. This study's purpose was to analyse both multi-year and individual year admissions data to assess predictors of student success in the Auburn University Harrison School of Pharmacy programme.

Methods

The study included student pharmacists who graduated in 2014, 2015, and 2016 Harrison School of Pharmacy. Student admissions data (PCAT individual and composite percentile rank scores, prerequisite pre-pharmacy science and cumulative GPAs, interview scores, pre-pharmacy coursework completed at our institution, attainment of prior degree [bachelor's or higher], initial admission decision, and campus assignment) were evaluated and compared to selected student outcomes (final pharmacy cumulative [FPC] GPA, letter grades in three science and therapeutics course sequences, and NAPLEX passage on the first attempt) to identify predictors of student success. Three types of interview scores (faculty/staff, student, and team activity) were evaluated separately. Admissions decision was categorised as accepted or deferred then subsequently accepted. Campus assignment was designated as main or satellite. Letter grades were converted for analysis, A=4, B=3, *etc*. If a course was repeated, only the first course grade was included. Grades were averaged for each of the three course sequences: Drug and Diseases (DAD), 26 hours in four semesters over the first two years; Drug Products (DP), six hours in two semesters during the second year; and Integrated Pharmacotherapy (IP), 24 hours in four modular courses over two semesters in the third year.

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DAD and DP are science courses. IP is a therapeutics course.

The primary objective was to identify which individual student's admission characteristics predicted success in the programme based on the outcome measures. Secondary objectives were to identify differences in predictors between the multi-year and individual year class data of 2014, 2015, and 2016.

Descriptive statistics were performed within Microsoft Excel®. Bivariate associations were examined with Pearson's correlations and simple linear regressions for continuous outcomes and simple logistic regression for binary outcomes. For correlations, a power analysis indicated that a sample size of 123 was sufficient to achieve 80% power, with a modest effect size of 0.25. The a *priori* significance level was 0.05 for all analyses. Statistical analyses were conducted via SAS® v9.4 (SAS Institute, Cary, NC). The University's institutional review board approved the study.

Results

The analyses included 417 students. Students (n=4) who did not graduate between 2014 and 2016 were excluded. Table I describes demographics of the admissions data.

Table I: Demographics class data of multi- and individual years

Graduation Year	Multi-Year	2014	2015	2016
Number of students, n	417	147	139	131
Has prior degree, n (%)	277 (66)	104 (71)	90 (65)	83 (63)
Pre-pharmacy coursework at our institution, n (%)	219 (53)	70 (48)	77 (55)	72 (55)
Assigned to main campus, n (%)	349 (84)	125 (85)	115 (83)	109 (83)
Deferred Initially, n (%)	30 (7)	15 (11)	15 (11)	0 (0)
Pre-pharmacy cumulative GPA, mean (SD)	3.34 (0.41)	3.26 (0.47)	3.4 (0.38)	3.35 (0.36)
Pre-pharmacy science GPA, mean (SD)	3.24 (0.49)	3.16 (0.54)	3.31 (0.47)	3.24 (0.43)
PCAT Composite score, mean percentile ranking (SD)	60 (20)	62 (18)	59 (20)	57 (21)
PCAT Biology score, mean percentile ranking (SD)	66 (20)	67 (19)	67 (20)	65 (21)
PCAT Chemistry score, mean percentile ranking (SD)	58 (21)	59 (20)	60 (21)	56 (23)
PCAT Verbal score, mean percentile ranking (SD)	62 (23)	65 (21)	62 (23)	59 (23)
PCAT Reading score, mean percentile ranking (SD)	54 (23)	57 (21)	53 (23)	52 (23)
PCAT Quantitative score, mean percentile ranking (SD)	49 (21)	50 (21)	48 (20)	50 (23)

The pre-pharmacy cumulative and science GPA and PCAT composite and chemistry score consistently correlated with FPC GPA and all course grades for the multi-year and each individual class analyses (Tables II and III). Pre-pharmacy cumulative and science GPAs were the strongest predictors of the FPC GPA and course grades. Pre-pharmacy cumulative GPA was a stronger predictor of therapeutic course grades, (r=0.50-0.51, p<0.0001). Pre-pharmacy science GPA was the stronger predictor for science course grades (r=0.41-0.51, p<0.0001).

For the multi-year data, all PCAT scores were significant for predicting the FPC GPA and all three course grades. Interview and team activity scores correlated with the FPC GPA and all course grades. Pre-pharmacy coursework completed at our institution only correlated with FPC GPA, the DAD and IP course grades. Campus assignment only correlated with the IP course grades. An initial deferral negatively correlated with the FPC GPA and all three course grades. A prior degree negatively correlated with the FPC GPA, and DAD and IP course grades.

For the individual class data, correlations varied by year. Tables II and III list all correlations.

Table II: Correlations between admissions data and final pharmacy cumulative GPA for multi- and individual years

	Pearson Correlations (r) for Final Pharmacy Cumulative GPA			
Year	Multi-Year	2014	2015	2016
Admissions Data				
Pre-pharmacy cumulative GPA	0.51*	0.45*	0.53*	0.55*
Pre-pharmacy science GPA	0.49*	0.45*	0.51*	0.5*
PCAT Composite score	0.33*	0.22†	0.42*	0.45*
PCAT Chemistry score	0.33*	0.19†	0.38*	0.49*
PCAT Biology score	0.2*	0.1	0.27†	0.3†
PCAT Verbal score	0.22*	0.13	0.29†	0.32†
PCAT Reading score	0.22*	0.14	0.37*	0.25†
PCAT Quantitative score	0.27*	0.19†	0.31†	0.38*
Has prior degree	-0.13†	-0.03	-0.2†	-0.18†
Pre-pharmacy coursework at our institution	0.15†	0.1	0.24†	0.1
Assigned to main campus	0.09	-0.01	0.21†	0.11
Deferred Initially	-0.22*	-0.24†	-0.28†	-0.14
Faculty/Staff Interview Score	0.17†	0.11	0.26†	0.26†
Student Interview Score	0.17†	0.13	0.21†	0.24†
Team Activity Score	0.14†	0.14	0.03	0.29†

* p<0.0001
† p<0.05
GPA: grade point average; PCAT: Pharmacy College Admissions Test

Table III: Correlations between admissions data and course sequences grades for multi- and individual years

	Pearson Correlations (r) for Course Sequences Grades											
Year	**Multi-Year**			**2014**			**2015**			**2016**		
Courses	DAD	DP	IP	DAD	DP	IP	DAD	DP	IP	DAD	DP	IP
Admissions Data												
Pre-pharmacy cumulative GPA	0.45*	0.47*	0.51*	0.42*	0.49*	0.5*	0.43*	0.42*	0.51*	0.52*	0.49*	0.5*
Pre-pharmacy science GPA	0.46*	0.47*	0.48*	0.46*	0.51*	0.49*	0.44*	0.41*	0.5*	0.48*	0.48*	0.43*
PCAT Composite score	0.35*	0.41*	0.34*	0.21†	0.3†	0.22†	0.46*	0.48*	0.46*	0.4*	0.46*	0.36*
PCAT Chemistry score	0.36*	0.38*	0.36*	0.22†	0.27†	0.25†	0.47*	0.41*	0.39*	0.41*	0.46*	0.42*
PCAT Biology score	0.25*	0.27*	0.17†	0.12	0.15	-0.01	0.32*	0.34*	0.33*	0.32†	0.33*	0.19†
PCAT Verbal score	0.2*	0.29*	0.23*	0.1	0.17†	0.13	0.28*	0.33*	0.32*	0.25†	0.37*	0.25†
PCAT Reading score	0.21*	0.3*	0.3*	0.11	0.24†	0.27†	0.34*	0.39*	0.42*	0.19†	0.3†	0.22†
PCAT Quantitative score	0.3*	0.27*	0.22*	0.26	0.18†	0.13	0.37*	0.33*	0.26†	0.39*	0.3†	0.32†
Has prior degree	-0.11†	-0.08	-0.14†	-0.02	-0.04	-0.1	-0.14	-0.03	-0.18†	-0.16	-0.15	-0.14
Pre-pharmacy coursework at our institution	0.14†	0.08	0.12†	0.12	0.05	0.06	0.2†	0.14	0.2†	0.09	0.05	0.07
Assigned to main campus	0.12	0.08	0.16†	0.05	0.11	0.11	0.22†	0.15	0.21†	0.08	-0.03	0.17†
Deferred Initially	-0.2*	-0.22*	-0.22*	-0.26†	-0.26†	-.31†	-0.22†	-0.3†	-0.28†	-0.07	-0.17	-0.09
Faculty/Staff Interview Score	0.15†	0.14†	0.2*	0.13	0.04	0.16	0.15	0.24†	0.27†	0.23†	0.15	0.2†
Student Interview Score	0.13†	0.14†	0.17†	0.1	0.04	0.16	0.11	0.19†	0.19†	0.24†	0.19†	0.18
Team Activity Score	0.13†	0.12†	0.15†	0.15	0.19†	0.16	0.01	-0.03	0.06	0.23†	0.2†	0.25†

* $p<0.0001$

† $p<0.05$

GPA: grade point average; PCAT: Pharmacy College Admissions Test; DAD: Drug and Diseases; DP: Drug Products; IP: Integrated Pharmacotherapy

For the classes of 2014 and 2015, only the biology PCAT score (p=0.0013) and pre-pharmacy science GPA (p=0.0061) predicted passing the NAPLEX. As scores increased, the probability in passing the NAPLEX increased. Due to the NAPLEX format change for the class of 2016, results were analysed separately. A higher chemistry PCAT score (p=0.0024) and team activity score (p=0.0099) increased the probability in passing the NAPLEX.

Discussion

The study is unique in that the authors evaluated three years of combined data, separately evaluated individual years and then compared findings. The only consistent significant individual predictors for FPC GPA and course grades in the multi-year and individual year analyses were pre-pharmacy cumulative and science GPA and PCAT composite and chemistry scores. Traditionally in the admissions deliberations, the PCAT focus has been on the chemistry and biology sections, which did not match the authors' findings showing the strongest correlations with composite and chemistry scores. Negative correlations were found if a student was initially deferred. These findings have since refocused us to scrutinise closely these applicants prior to making final admissions decisions. To the authors' knowledge, this study is the first to examine deferred then subsequently admitted students as a predictor of success. The inconsistency between the three individual years of class data illustrates differences in how class characteristics may affect predictors of success.

Limitations include that the authors' evaluated two years of NAPLEX data combined. The NAPLEX changed in November 2015; thus, the 2016 data were evaluated separately. Outcomes of the two analyses varied. Interview structures vary per school and domains assessed may differ, thus the team activity and interview scores may lack extrapolation. Finally, practice abilities and professional demeanour were not assessed outcomes.

Conclusion

The pre-pharmacy cumulative and science GPAs and PCAT composite and chemistry scores consistently correlated with FPC GPA and all course sequence grades for the multi-year and individual class data analyses. When evaluating individual years of class data, outcomes differed between each year. Thus, multi-year and individual year analyses are most beneficial in determining predictors.

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