An Evaluation of the Pharmacy College Admissions Test as a Tool for Pharmacy College Admissions Committees

Katherine A. Kelley, Kristina Secnik and Mark E. Boye

College of Pharmacy, Ohio State University 500 West 12th Avenue Columbus OH 43210-1291

The purpose of this study was to determine the capacity of the PCAT to predict success in pharmacy school. *T*-tests were used to test for differences in mean PCAT scores by gender, race and native language. Regression analysis was used to explain first-quarter pharmacy GPA utilizing pre-pharmacy GPA and PCAT scores as the independent variables. *T*-test results yielded statistically significant differences in mean PCAT scores between groups on all three demographic variables. The adjusted R^2 values for the regression model (N=360) explaining pharmacy GPA using PCAT and pre-pharmacy GPA together (R^2=0.353) were the best indicators. The analysis of average pharmacy GPA by PCAT decile showed that below a composite percentile score of 40, the average first-quarter GPA fell below 2.0. PCAT used in combination with pre-pharmacy GPA is meaningful in assessing applicants to pharmacy school. Applicants with PCAT composite percentile scores below 40 should be given particularly careful attention.

INTRODUCTION

Colleges of Pharmacy in the United States continue to experience decreasing numbers of applicants to their professional programs a trend that began in the second half of the 1990s(1) (Table I). During this same time period pharmacy education in the U.S. has changed, in some cases dramatically, which has left colleges and their admissions committees with the challenge of recruiting and retaining qualified applicants to their pharmacy schools. Because of this decline in numbers of applicants, colleges of pharmacy should recognize and attempt to reduce barriers to program entry. In addition, admissions practices need to insure the assessment of applicant skills that are relevant to the new programs to which students are being admitted. This investigation was designed to evaluate the usefulness of one potential assessment tool — the Pharmacy College Admissions Test (PCAT).

Beginning with the 1997 admissions cycle, The Ohio State University (OSU) College of Pharmacy adopted the PCAT for use in its admissions process. After three admissions cycles requiring PCAT scores, the admissions committee had only a general idea of how well this test explained success in pharmacy school. The research reported in this article was conducted, with committee support, in order to assess and test performance in this student population. Data analyses from the first three admissions cycles (1997, 1998, 1999) were shared with the committee at the start of the fourth admission cycle (autumn 2000) with the hope that prior results would produce more informed admissions decisions with regard to the use the PCAT scores. Data from the fourth admission cycle (autumn 2000) were subsequently collected and analyzed to determine if the committee had successfully incorporated what was learned from the initial data analyses (admissions cycles for 1997, 1998, 1999) into their decision making process for the 2000 admissions cycle.

The PCAT was introduced in order to help discriminate between increasingly large applicant pools in the early 1970s, and numerous studies have reported on the early (pre-1990) stages of PCAT development(2). Results of this initial research suggested PCAT scores accounted for 18-60 percent of the variance in pharmacy school grade point average (GPA). Generally, in these studies, pharmacy school GPA was defined as the cumulative GPA at the end of the first professional year of study. While the PCAT study results are similar to studies on other admissions exams, these early studies varied in their ability to provide useful information for admissions committees. Authors of more recent articles(3-7) have also found varying results with regard to the usefulness of the PCAT in predicting pharmacy school success. In addition, studies have been reported on the usefulness of the PCAT in explaining minority student success(4) and the differences in PCAT score by gender(8) (see Appendix).

Am. J. Pharm. Educ., **65**, 225-230(2001); received 9/12/00, accepted 6/1/01.

Table I. Percentage increase(↑) or decrease(↓) in the number of applications versus prior year to pharmacy schools from 1990-2000

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2.8↑	11.3↑	24.9↑	13.7↑	2.4↑	2.9↓	1.7↓	13.4↓	10.5↓	11.7↓	1.7↓

Similar to most of the existing published literature on PCAT, data for this investigation were collected from a single institution. Results from a single study, however, are seldom conclusive and rarely generalizable. The purpose of this research, therefore, was to further extend our knowledge and strengthen (or weaken) generalizations regarding the association between PCAT scores and pharmacy school GPA within the context of our new educational environment. In sum, does this test provide information that is useful to admissions committees or is it merely a barrier for the applicant? Careful evaluation should be given to the continued use of this test at a time when the challenges to admissions committees (*i.e.*, decreasing numbers of applicants and a graduate professional curriculum versus an undergraduate professional curriculum) are vastly different from the time that the test was developed.

RESEARCH QUESTIONS

The following research questions were investigated.

1. What differences in average PCAT scores exist by gender, race and native language?
2. To what extent does knowledge of student's PCAT score explain success in pharmacy school?
3. To what extent does knowledge of student's pre-pharmacy GPA explain success in pharmacy school?
4. To what extent does knowledge of student's PCAT score and pre-pharmacy GPA explain success in pharmacy school?
5. Is there a threshold PCAT score below which we can explain that a student will earn a first-quarter pharmacy GPA below 2.0?
6. Can a retrospective review of admissions data at the start of a new admissions cycle inform and improve an admissions committee's decisions?

METHODS

Data for this study were gathered via a retrospective file review of students entering The Ohio State University College of Pharmacy in autumn of 1997, 1998 and 1999 (autumn 2000 data were analyzed separately as described later). The students' PCAT score, pre-pharmacy GPA, race, gender, native language, and first-quarter pharmacy GPA were extracted from their files. *T*-tests were used to determine statistically significant differences in: (*i*) mean composite PCAT percentile score; (*ii*) mean pre-pharmacy GPA; and (*iii*) mean pharmacy GPA - by race, gender, and native language. Due to sparse data, race was dichotomized (majority and minority), thereby collapsing the five race categories captured on the application for admission. Minority and majority race categories were designated according to results reported in the American Association of Colleges of Pharmacy's 1997-98 Profile of Pharmacy Students(9). White and Asian races (majority) accounted for 75.8 percent of the applicant total (46.1 and 29.7 percent, respectively). The remaining (majority) 24.2 percent consisted of Blacks, Hispanics, and Native Americans (9.0, 3.6, and 0.4 percent, respectively).

Data from these analyses were reviewed by the admissions committee prior to the start of the admissions cycle for autumn 2000. At the end of the autumn quarter of 2000, another analysis was run on the data from only the students who entered the college autumn of 2000.

Pharmacy school GPA (measured at the end of the first academic quarter) was used as a proxy measure of academic success and represented the dependent variable in this study's regression analytic framework. For the purposes of this study, student GPA was restricted to first academic-quarter records; studies have shown most academic difficulties in pharmacy school will have occurred within the first program year(10,11).

Table II. Demographic data

	N	Percent
Gender		
Male	147	40.8
Female	213	59.2
Race[a]		
Majority[b]	338	93.9
Minorityc	19	5.3
Native Language		
English	326	90.6
Not English	34	9.4

[a]Does not total 360 or 100% due to missing data.
[b]Asian and white.
[c]Hispanic, Black and Native American.

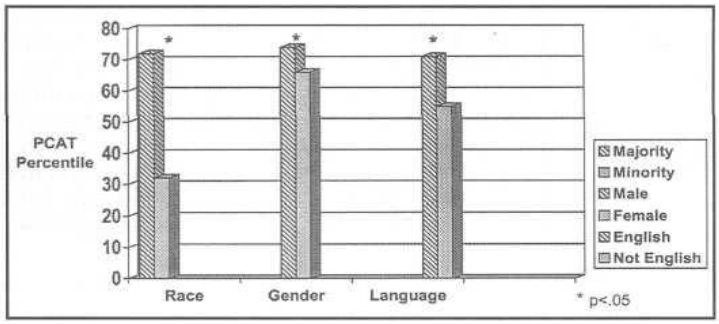

Fig. 1. Mean composite PCAT percentile by demographic variable.

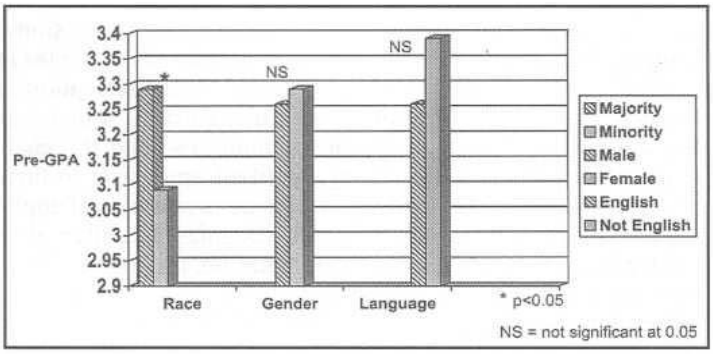

Fig. 2. Pre-pharmacy GPA by demographic variable.

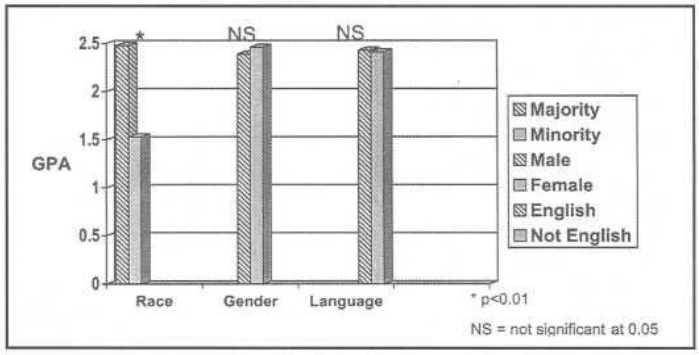

Fig. 3. Pharmacy school GPA by demographic variable.

Table III. Standardized and unstandardized coefficients and R^2 values for the regression models (N=360)

Predictor	Unstandardized coefficient	Standardized coefficient	*P* value	Adj. R^2
Model 1[a]				0.244
PCAT	0.017	0.020	0.001	
Model 2[b]				0.179
Pre-pharmacy GPA	1.091	0.368	0.001	
Model 3[C]				0.353
Pre-pharmacy GPA	0.866	0.292	0.001	
PCAT	0.014	0.368	0.001	

[a] Model 1 intercept constant = 1.259. [b] Model 2 intercept constant = -1.147. [c] Model 3 intercept constant = -1.416.

Furthermore, the first-quarter data limit was imposed in order to use the most inclusive data set. According to OSU academic guidelines, students who fail courses are not permitted to continue on in the curriculum therefore, first-quarter professional GPA provided the most inclusive set of data for the dependent variable. First-quarter GPA was regressed on pre-pharmacy GPA, PCAT composite percentile scores, and both pre-pharmacy GPA and PCAT scores. Significant differences between model R^2 values were tested with the F-statistic. The test level for statistical significance was set a priori to 0.05. All analyses (including demographic statistics, regression analyses, regression diagnostics, and *t*-tests) were conducted using Stata® 6.0 software(12). Additionally, mean first-quarter pharmacy GPA was tabulated by decile of PCAT composite percentile score.

The data collected and analyzed above were shared with the admissions committee at the start of the 2000 admissions cycle and were periodically referenced when issues or questions about PCAT scores were encountered throughout the admissions decision making process. After the grades were posted for the first-quarter of pharmacy school, the 76 newly admitted students' PCAT scores and pre-pharmacy GPAs were analyzed. Regression analysis was used with first-quarter GPA as the dependent variable and PCAT composite, PCAT section scores, and pre-pharmacy GPA as the independent variables. In addition, the decile analysis described above was also repeated for the 76 newly admitted students.

RESULTS

A total of 360 students began their studies in the College of Pharmacy during the 1997-98, 1998-99, 1999-2000 school years (Table II). All cases were included in two-sample *t*-tests to determine if there were any statistically significant differences between mean PCAT scores, mean first-quarter GPA, or mean pre-pharmacy GPA by demographic grouping variables (gender, race, and native language). Statistically significant differences in mean PCAT score were found across all three demographic grouping variables. Only when the data were grouped by race were there statistically significant differences in mean first-quarter and pre-pharmacy GPAs. See bar graphs in Figures 1-3 for representations, by demographic variables, of mean composite PCAT score, pre-pharmacy GPA, and pharmacy-school GPA, respectively.

The estimated combined Model 3 (pre-pharmacy GPA and PCAT score, adjusted $R^2 = 0.353$) explained significantly more variance in first-quarter GPA compared with either Model 1 (PCAT score alone, adjusted $R^2 = 0.244$) or Model 2 (pre-pharmacy GPA alone, adjusted $R^2 = 0.179$), Fs (1, 357) = 60.97 and 96.45, respectively (Table III). Although the difference is not statistically testable, PCAT scores alone accounted for more explained first-quarter GPA variance compared with pre-pharmacy GPA alone.

Table IV. Average first-quarter pharmacy GPA by decile of PCAT composite percentile (N=360)

PCAT composite Percentile	Mean GPA	N (%)
90-99	2.82	99 (275)
80-89	2.64	66 (18.3)
70-79	2.56	50 (13.9)
60-69	2.44	26 (7.2)
50-59	2.26	41 (11.4)
40-49	2.02	23 (6.4)
30-39	1.93	20 (5.6)
20-29	1.88	13 (3.6)
10-19	1.49	16 (4.4)
1-9	0.71	6 (1.7)

Beta weights for x-standardized multiple regression coefficients were reviewed to assess the relative importance of the two variables in explaining Model 3 first-quarter GPA. Both unstandardized and x-standardized regression weights are presented in Table III. An increase of one standard deviation in PCAT scores was associated with an increase of 0.37 in first-quarter GPA whereas an increase of one standard deviation in pre-pharmacy GPA was associated with an increase of only 0.29 in first-quarter GPA. Both coefficients were statistically different from the null value of zero.

Regression assumptions for the full model (Model 3) were checked and satisfied with no multicollinearity (Mean VIF = 1.04) and no heteroscedasticity (White's general test statistic = 10.95, $P = 0.0523$) violations. Autocorrelation was assumed not to be a problem in the model estimation because no time-series data were included in the regression equation.

Results of the tabulation of first-quarter GPA by decile of PCAT score are presented in Table IV. PCAT composite percentile scores below the 40th percentile yield average first-quarter GPA's below 2.0. Upon further investigation of the 55 students with PCAT scores below the 40th percentile, it was found that those who achieved a first-quarter GPA above a 2.0 all had PCAT science (biology or chemistry) percentile scores above the 40th percentile. This fact led the committee to request that the analysis of the autumn 2000 data by regression analysis using the PCAT component scores, in addition to the composite score, to explain first-quarter pharmacy GPAs.

Results of the regression analysis of the autumn 2000 data are presented in Table V, and results of the average first-quarter pharmacy school GPA by PCAT decile scores are presented in Table VI. The best indicator of first-quarter pharmacy school GPA was again the combination of PCAT composite and pre-

Table V. Standardized and unstandardized coefficients and R^2 values for the regression models for the autumn 2000 admitted class (N=76)

Predictor	Unstandardized Coefficient	Standardized coefficient	*P* value	Adj. R^2
Model 1[a]				0.221
PCAT composite	0.0167	0.481	0.001	
Model 2[b]				0.387
Pre-pharmacy GPA	1.337	0.629	0.001	
Model 3[c]				0.511
Pre-pharmacy GPA	1.175	0.552	0.001	
PCAT composite	0.0127	0.366	0.001	
Model 4[d]				0.043
PCAT Verbal	0.0071	0.236	0.041	
Model 5[e]				0.114
PCAT Biology	0.0116	0.355	0.002	
Model 6[f]				0.158
PCAT Reading	0.0128	0.411	0.001	
Model 7[g]				
PCAT Quantitative	0.0121	0.372	0.001	
Model 8[h]				0.178
PCAT Chemistry	0.0139	0.435	0.001	

[a] Model 1 intercept constant = 1.424. [c] Model 3 intercept constant = -2.165. [e] Model 5 intercept constant = 1.841. [g] Model 7 intercept constant = 1.801.
[b] Model 2 intercept constant = -1.759. [d] Model 4 intercept constant = 2.217. [f] Model 6 intercept constant = 1.851. [h] Model 8 intercept constant = 1.609.

Table VI. Average first-quarter pharmacy GPA by decile of PCAT composite percentile for autumn 2000 class (N=76)

PCAT composite percentile	Mean GPA	N (%)
90-99	3.14	25 (33.3)
80-89	2.62	13 (17.3)
70-79	2.61	10 (13.3)
60-69	2.43	11 (14.7)
50-59	2.49	7 (9.3)
40-49	2.56	2 (2.7)
30-39	1.15	3 (4.0)
20-29	2.47	3 (4.0)
10-19	1.69	2 (2.7)
1-9	0	0

pharmacy GPA (R^2=0.524). Only eight students were admitted with PCAT composite scores below the 40th percentile, and after the first-quarter of study five of the eight had pharmacy school GPAs below 2.0.

DISCUSSION AND IMPLICATIONS

The purpose of this study was to gather and analyze admissions data in order to determine the suitability of using PCAT scores to explain pharmacy school success within the context of our new PharmD educational environment. Moreover, we wanted to determine if the value of the PCAT information outweighs its serving as a potential barrier to pharmacy school applicants. Results of this investigation suggest PCAT is a valuable tool in the assessment of applicants to a college of pharmacy's PharmD program.

The PCAT can be a viewed as a barrier to entry for the colleges or schools that choose to require this extra step in the admissions process. About half (52 percent, n = 42) of the 81 United States schools of pharmacy utilized the PCAT in admissions decisions during the academic years 1999 and 2000(13,14). This percent represents a drop from the 1998-1999 school year when 70 percent of schools required PCAT(15). Additionally, the exam is only offered three times per year in limited geographical locales; this may exclude or discourage an otherwise qualified candidate from applying to a school requiring the PCAT. Given that there is a trend of decreasing numbers of students applying to pharmacy schools (Table I), and the requirement of PCAT can be viewed as a barrier to admission to pharmacy school, the information provided to admissions committees necessarily must be substantially informative. The results of this study indicate that a conscientious admissions committee can utilize this test, particularly when combined with pre-pharmacy GPA, to determine which students may be in academic difficulty after one quarter of course work. For the class entering autumn of 2000, more than 50 percent of the variance in first-quarter pharmacy GPA can be accounted for by the combination of pre-pharmacy GPA and PCAT composite percentile.

The results of the *t*-tests of mean PCAT scores indicate statistically significant differences between the groups tested (*i.e.*, gender, race and native language). However, the practical significance of these differences would probably not be relevant in admissions decisions. For example, the average PCAT composite for men was 74.2 and the composite percentile for women was 66.3; a score of 66 would not likely keep a candidate from being admitted. Gender differences in PCAT performance (*i.e.*, males outscore females) were also reported by Kawahara and Ethington(8).

For the variable race, the average PCAT scores are cause for concern. The average PCAT composite percentile for minorities was 32 and the average first-quarter GPA was 1.53, even though minority applicants had an average pre-pharmacy GPA of 3.09. The West results warrant further attention with regard to the implications of the finding that minority students average first-quarter GPA is below 2.0 (*i.e.*, below good academic standing). The issues of success of minority students on a majority campus is unfortunately still one that faces all of higher education. Hale(16) presents a detailed theoretical framework describing the experiences of minority students in a majority setting. This work outlines the social and professional influences that shape the experiences of pharmacy students

and can serve as an informative tool in understanding the influences of environment on our minority pharmacy students(16). Certainly diversity and pluralism within our colleges are constant issues that we must continue to strive to improve. One potential suggestion from this research is that minority students should be more carefully followed once admitted to the College and measures taken to help them with the transition into professional curricula. Greater attention, more resources, or both need to be committed to recruitment and retention of qualified minority pharmacy students.

From the statistical regression analysis (Table III), the combination of pre-pharmacy GPA and PCAT accounts for almost two times more of the variance in first-quarter GPA than does pre-pharmacy GPA alone (36 versus 18 percent). The PCAT alone accounts for approximately 25 percent of the variance in first-quarter pharmacy GPA for the first three admissions cycles investigated and approximately 23 percent of the variance in first-quarter pharmacy GPA for the class entering autumn 2000. These values are similar to values reported previously in the literature(2-4,6). This finding is also comparable to variance predicted by other post baccalaureate entrance exams such as the GRE and MCAT(2).

Results (Table V) of this study also support the use of the PCAT composite (adjusted R^2= 0.221) rather than individual scores of the component sections (adjusted R^2 values Verbal = 0.043; Biology = 0.114; Reading Comprehension = 0.158; Quantitative = 0.127; Chemistry = 0.178). An additional benefit of these analyses has been that the admissions committee has approached the autumn 2001 admissions cycle with a greater degree of confidence in their understanding of the meaning of the PCAT score within the context of PharmD admissions. We could argue that by viewing the analysis presented here of the 1997-1999 data prior to the autumn 2000 cycle they were able to make more informed decisions (*i.e.*, the variance explained by the combination of pre-pharmacy GPA and PCAT in first-quarter pharmacy GPA went from 35 to 51 percent.

The finding that PCAT scores below the 40th percentile yield first-quarter GPA's less than 2.0 should not be used as justification for a cut-off point for admissions decisions. However, careful attention should be given to applicants with PCAT composite percentiles below 40. While it is tempting to "draw a line in the sand" below which applicants are rejected, we need to keep in mind the subjectivity of the process which we are administering. We are admitting future professionals to our programs with the hope that they will succeed in our curriculums and then join the professional ranks. One single piece of data gathered by a one-day test should not function as the sole determinant or gatekeeper to the profession of pharmacy. Admissions decisions are subjective because they are based on human beings that inherently possess a great deal of variability. The key then is to find a combination of tools that we can incorporate into informed decisions to help us select the best possible applicants.

LIMITATIONS

The study results may be biased by the fact that the sample contains data from a single institution and is limited to only students admitted to pharmacy school. The data used in this study also were limited in their ability to explain success in pharmacy school for either race or native language. Both of these groups were underrepresented in the sample because of their low enrollment in the College during the 1997-98, 1998-99 and the 1999-2000 admissions classes. Future research in this area should include samples with a more diverse population of pharmacy students. Additionally, a multi-institution evaluation of PCAT may prove beneficial.

SUMMARY

In the new PharmD educational environment, the PCAT is a valuable tool for use in the pharmacy school admissions process. Even given that the test adds another step in the process of admissions, these authors believe that the information outweighs the potential for the PCAT to function as a barrier to pharmacy school admissions. Although there are statistically significant differences between groups in mean composite percentile PCAT score on the variables of gender, race and native language, these differences are probably not practically meaningful. Race was the only variable where statistically significant differences were maintained across pre-pharmacy GPA, PCAT composite percentile, and first-quarter pharmacy GPA. However, the low number of students in the minority group could have biased this result. The lack of statistical power to detect a difference should not be used as a justification for decreasing the attention we need to pay to the real issue of minority recruitment and retention. The two independent variables, pre-pharmacy GPA and PCAT composite percentile scores, explain approximately 35 to 51 percent of the variance in first-quarter pharmacy GPA. There appears to be a critical threshold of PCAT scores (<40) below which the average GPA after one quarter of study is less than 2.0. The findings in this study suggest that the PCAT is a valuable tool for helping admissions committees evaluate applicants, however, we must also keep in mind the qualitative nature of the admissions process and maintain a humanistic approach to this important process.

Acknowledgement. The authors would like to thank OSU's PharmD admission committee and Dean John M. Cassady for support in this study.

References

(1) American Association of Colleges of Pharmacy, Profile of pharmacy students, American Association of Colleges of Pharmacy, Alexandria VA (1990-2000).

(2) Cunny, K.A. and Perri, M., "Historical perspective on undergraduate pharmacy student admissions: the PCAT," *Am. J. Pharm. Educ*., **54**, 1-6(1990).

(3) Cox, F.M. and Teat, D.W., "Predictors of academic performance in a doctor of pharmacy training program," *J. Pharm. Teach*., **2**, 45-57(1991).

(4) Charupatanapong, N. and Richard, A., "Predicting the academic performance of pharmacy students at a predominantly black institution," *ibid.,* **4**,21-33(1993).

(5) Chisholm, M.A., Cobb, H.H. and Kotzan, J.A., "Significant factors for predicting academic success of first-year pharmacy students," *Am. J. Pharm. Educ*., **59**, 364-370(1995).

(6) Wu-Pong, S. and Windridge, G., "Evaluation of pharmacy school applicants whose first language is not English," *ibid.,* **61**, 61-66(1997).

(7) Chisholm, M.A., Cobb, H.H., DiPiro, J.T. and Lauthenschlager, G.J., "Development of a model that predicts the academic ranking of first-year pharmacy students," *ibid.,* **63**, 388-394(1999).

(8) Kawahara, N.E. and Ethington, C., "Performance on the pharmacy college admissions test: an exploratory analysis," *ibid.,* **58**, 145-150(1994).

(9) American Association of Colleges of Pharmacy, Profile of Pharmacy Students American Association of Colleges of Pharmacy, Alexandria VA (1998).

(10) Friedman, C.B., Lage, G., Norwood, J. and Stewart, J., "Predictive validity of the pharmacy college admission test," *Am. J. Pharm. Educ*., **51**, 288-291(1987).

(11) Chisholm, M.A., Cobb, H.H., Kotzan, J.A. and Lautenschlager, G., "Prior four-year degree and academic performance of first-year pharmacy students: A three year study," *ibid.,* **61**, 278-281(1997).

(12) Stata Statistical Software: Release 6.0, Stata Corporation, College Station, TX(1999)
(13) American Association of Colleges of Pharmacy, Pharmacy School Admissions Requirements, American Association of Colleges of Pharmacy, Alexandria VA(1999-2000).
(14) American Association of Colleges of Pharmacy, Pharmacy School Admissions Requirements, American Association of Colleges of Pharmacy, Alexandria VA(2000-2001).
(15) American Association of Colleges of Pharmacy, Pharmacy School Admissions Requirements, American Association of Colleges of Pharmacy, Alexandria VA(1998-1999).
(16) Hale, K.M., Social and Professional Border Lines The Experiences of African-American and White Pharmacy Students at a Predominantly Black and Predominantly White Institution, Dissertation, The Ohio State University, Columbus OH(1995).

APPENDIX. SUMMARY OF LITERATURE ASSESSING PCAT SINCE 1990

Authors	Year	Research Question(s)	Major Finding
F. Cox D. Teat	1991	Correlation between admissions criteria and pharmacy school academic performance (*i.e.,* GPA).	Pre-pharmacy GPA (as measured by the cumulative GPA after the 1st 2nd and 3rd years) is a strong predictor of academic performance. PCAT biology scores when used with pre-pharmacy GPA are predictive. Reading comprehension and verbal PCAT scores were not significant predictors.
N. Charupatan-apong C. A. Richard	1993	Identification of factors that predict minority pharmacy student performance; investigate the relationship between minority student performance and PCAT, pre-pharmacy GPA and pharmacy GPA.	Pre-pharmacy GPA and PCAT quantitative scores were the best predictors of pharmacy school GPA (measured as the current cumulative GPA across 3 classes). PCAT reading comprehension was the least predictive variable.
N. Kawahara C. Ethington	1994	Evaluation of pharmacy student performance in general, and to evaluate gender differences in PCAT scores.	General trend toward declining student performance over time. Males consistently outscored females on the PCAT with a difference of 4-8 percentage points depending on subsection.
M. Chisholm H. Cobb J. Kotzan	1995	Evaluation of factors that predict pharmacy school success. Compare old and new PCAT on predictive capacity. Identification of most important academic success predictors.	Best overall predictors of success (as measured by first-year pharmacy school GPA) were pre-pharmacy math/science GPA and a prior 4-year degree. Both the old and new PCAT were found to be non-significant predictors of pharmacy school success.
S. Wu-Pong G. Windridge D. Osborne	1997	Evaluation of first language and other variables as predictors of pharmacy school success.	First language was not predictive of success. PCAT biology, chemistry and verbal scores, biology GPA, chemistry GPA, high rank and SAT verbal scores used in combination were predictive of pharmacy school success (measured as first-year pharmacy GPA).
M. Chisholm H. Cobb J. DiPiro G. Lauthen-schlager	1999	Evaluation of pre-pharmacy GPA, PCAT and prior 4-year degree in predicting performance ranking of pharmacy students.	Pre-pharmacy math and science GPA and prior 4-year degree (not PCAT) were the best predictors of academic rank for first year students.