

Prior Four Year College Degree and Academic Performance of First Year Pharmacy Students: A Three Year Study

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The objective of the study was to determine whether students who achieved a four-year college degree prior to entering pharmacy school had significantly higher first year pharmacy school grade point averages than students without a prior four year college degree. All students who entered the University of Georgia College of Pharmacy during 1992, 1993, and 1994 were included in the study. A total of 342 pharmacy student records were audited from the entering professional classes of 1992, 1993, and 1994. Four way analysis using the general linear model procedure was performed on the total study population (1992-1994) to determine whether degree, age, class-year, math/science prepharmacy grade point average, or any interaction term involving these variables was a significant factor contributing to the academic performance of first year pharmacy students. Analysis using the general linear model procedure was used to determine whether ages of students were different according to degree status (students with or without four year college degrees). For all years, students with a prior college degree performed significantly better than students without a prior college degree ($P < 0.05$). The difference in grade point averages that existed between students was significantly associated with degree status and math/science prepharmacy grade point average, not age or class-year. The overall model R-square is 0.38 (the math/science prepharmacy GPA and the degree partial r-square is 0.28 and 0.10 respectively). The Pearson correlation coefficient of 0.52 and the variance inflation factor (age=1.37; degree=1.33) revealed no adverse effect of collinearity between age and degree in our model. This study validates that students with prior four year college degrees had significantly higher first year grade point averages than students without degrees in this population. Significance and implications of the results for pharmacy admission procedures are discussed.

INTRODUCTION

Identifying and selecting students who are likely to be successful in pharmacy school is an important task. Presently, prepharmacy GPA (grade point average) and Pharmacy College Admission Test (PCAT) scores are the most popular objective measures used by schools of pharmacy to evaluate prospective students for admission. Every American Association of Colleges of Pharmacy (AACCP) member school utilizes some form of prepharmacy GPA in evaluating students for admission, and approximately 50 percent of schools utilize PCAT scores. The literature describing the value of pre pharmacy GPA and PCAT scores in predicting students' academic performances, defined by pharmacy school GPA, differs from population to population and is inconsistent from year to year(1-8).

Unlike most medical and dental students, pharmacy students generally do not have a four year college degree prior to entering the professional program. According to the Profile of Pharmacy Students, 21 percent of the applications to first professional degree programs during the 1993-1994 academic year were submitted by individuals who previously obtained a baccalaureate degree(9). In addition, a literature search from 1976 to 1996 yielded limited information on the association of achieving a prior four year college degree and first year pharmacy school GPA(1,8). More than nineteen years ago (1978), Torosian and colleagues demonstrated that students without a prior baccalaureate degree

had a higher correlation coefficient than students with a degree when the dependent variable was overall pharmacy school GPA (0.573 vs. 0.250)(1). This study did not indicate whether students with degrees performed better than students without degrees in pharmacy school. Seventeen years after the Torosian report (1995), a study was published that suggested achievement of a prior four year college degree was a significant factor in predicting the academic performance of first-year pharmacy students(8). In light of the two reports, several questions remain: Do students with a four year college degree prior to pharmacy school perform significantly better than students without a prior college degree? If so, is the achievement of a prior four year college degree a stable significant predictive factor from year to year?

The purpose of this research was to evaluate the significance of achieving a prior four year college degree on the academic performance of first year pharmacy students. Specific objectives of the study were to: (i) evaluate the academic performance of first-year pharmacy students for three consecutive years; and (ii) determine whether students who achieved a four year college degree prior to entering pharmacy school had significantly different first-year pharmacy school grade point averages than students without a prior four year college degree.

METHODOLOGY

Sample

The study population consisted of 342 students who

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Table I. First professional year required courses at the University of Georgia College of Pharmacy as of Summer 1995

Course title	Credit hours
Anatomical Basis for Medical Physiology	5
Pharmacy Calculations	3
Introductory Medicinal Chemistry	5
Medicinal Chemistry Laboratory	1
Biopharmacy I & II	7
Medical Physiology and Pathophysiology I & II	8
Pharmacy Law	4
Administrative Pharmacy	3
Pharmaceutics I & II	10

entered the University of Georgia College of Pharmacy in the fall of 1992, 1993, and 1994. Data were collected from records to provide the following information for each student enrolled in the study: (i) first-year pharmacy school grade point average for the period beginning Fall 1992 and ending Spring 1993; (ii) first-year pharmacy school grade point average for the period beginning Fall 1993 and ending Spring 1994; (iii) first-year pharmacy school grade point average for the period beginning Fall 1994 and ending Spring 1995; (iv) prepharmacy grade point average; (v) math/science prepharmacy grade point average; (vi) age at the end of year one of pharmacy school; and (vii) prior four year college degree status (whether or not the student achieved a four year college degree prior to entering pharmacy school).

Academic Performance

Each student's grade point average was determined by grades achieved in required pharmacy courses at the end of the student's first year in pharmacy school (Spring 1993, Spring 1994, or Spring 1995). The required pharmacy courses at the University of Georgia College of Pharmacy and their respective credit hours are displayed in Table I and first-year pharmacy grade point average (FYPGA) was determined by grades achieved in these classes. All grades incorporated in the study were based on a 4.0 grading structure. Students who did not complete the first year of pharmacy school due to academic failure or withdrawal were included in the study and their grade point averages earned at the point of withdrawal or academic failure were included in the analyses.

Statistics

Data obtained were coded and entered in a computer database and analyses were performed using SAS System, release 6.10. Analysis using the general linear model procedure was used to determine whether the FYPGA of students with a prior four year college degree was significantly different from students without a four year college degree for each individual year (1992, 1993, and 1994) and for the total population (1992-1994). Four way analysis using the general linear model procedure was performed on the total study population (1992-1994) to determine whether degree, age, class-year, math/science prepharmacy grade point average, or any interaction term involving these variables was a significant factor contributing to the academic performance of first-year pharmacy students. The variables of age and math/science prepharmacy grade point average were centered to minimize collinearity in the four way analysis. Analysis using the general linear model procedure was used

to determine whether ages of students were different according to degree status. A second analysis using the general linear model was used to determine whether there was a difference in the prepharmacy or math/science prepharmacy grade point average according to degree status. Stepwise multiple regression analyses were performed to determine the R-squares and partial r-squares of the models (with the variable math/science prepharmacy grade point average entered first, followed by degree). A selected level of $\alpha = 0.05$ was applied to the analyses. The Pearson correlation coefficient and the variance inflation factor under SAS regression procedure were used to assess the extent of collinearity between age and degree.

RESULTS

The results of the 1992, 1993, 1994, and 1992-1994 analyses are summarized in Tables II, III, and IV. This study included 342 students, 209 females (61.1 percent) and 133 males (38.9 percent). The mean age of the students at the end of their first year in pharmacy school was 23.56 years (SD=4.01). The mean FYPGA for the entire population was 3.16 (SD=0.48). The mean FYPGA for students with degrees was 3.49 (SD=0.38) and 3.09 (SD=0.47) for students without degrees ($P<0.01$). See Table II. Analysis using the general linear model revealed that there was a significant difference ($P<0.01$) between FYPGA of students with four year college degrees and students without four year college degrees for each study year (1992, 1993, and 1994). Analysis using the general linear model also revealed that there was a significant difference ($P<0.01$) in the ages of students with four year college degrees and without degrees for each study year. The general linear model (GLM) procedures using type III sums of squares revealed that the difference in FYPGA that existed between students was significantly attributed to degree status and math/science prepharmacy GPA ($P<0.001$), not age or class-year (See Table III). The overall model R-square is 0.38 (the math/science prepharmacy GPA and the degree partial R-square is 0.28 and 0.10 respectively), indicating that 62 percent of the total variance was not accounted for in this model (Table IV). Although the Pearson correlation coefficient is 0.52, the variance inflation factor under regression procedure (age=1.37; degree=1.33) revealed no adverse effect of collinearity between age and degree in the model.

DISCUSSION

In a previous study, the achievement of a four year college degree prior to pharmacy school and math/science prepharmacy GPA were significant factors for predicting the academic success of first-year pharmacy students(8). This finding was the impetus to conduct this follow-up study to directly compare academic performances of first year pharmacy students with and without prior four year college degrees. It is important to note that math/science prepharmacy GPA in the study population is a significant factor in predicting first year academic performance and therefore it was included in the overall model. However, unlike the previous study which evaluated the predictive value of PCAT scores and prepharmacy grade point averages to FYPGA(8), the major emphasis of this investigation was to examine the significance of prior degree status to students' FYPGA.

There was no significant difference in students' FYPGA between class years (1992, 1993, and 1994). Results of the

Table II. Population characteristics

	1992-1994	1992	1993	1994
Total number of students	342	120	116	106
Male	133 (38.9%)	50 (41.7%)	42 (36.2%)	41 (38.7%)
Female	209 (61.1%)	70 (58.3%)	74 (63.8%)	65 (61.3%)
Average age in years	23.56 ± 4.01	23.33 ± 3.95	23.50 ± 3.78	23.88 ± 4.34
FYPGPA	3.16 ± 0.48	3.08 ± 0.45	3.16 ± 0.51	3.23 ± 0.48
MSPGPA	3.23 ± 0.40	3.13 ± 0.46	3.26 ± 0.39	3.31 ± 0.34
Number of students with prior 4-year college degree	53 (15.5%)	17 (14.2%)	17 (14.7%)	19 (17.9%)
Male	22 (41.5%)	9 (52.9%)	6 (35.3%)	7 (36.8%)
Female	31 (58.5%)	8 (47.1%)	11 (64.7%)	12 (63.2%)
Average age in years	28.43 ± 4.87 ^a	28.29 ± 4.30 ^c	28.47 ± 4.72 ^e	28.53 ± 5.69 ^g
FYPGPA	3.49 ± 0.38 ^b	3.44 ± 0.42 ^d	3.43 ± 0.33 ^f	3.59 ± 0.39 ^h
MSPGPA	3.21 ± 0.39	3.07 ± 0.46	3.17 ± 0.30	3.38 ± 0.35
Number of students without prior 4-year college degree	289 (84.5%)	103 (85.8%)	99 (85.3%)	87 (82.1%)
Male	111 (38.4%)	41 (39.8%)	36 (36.4%)	34 (32.1%)
Female	178 (61.2%)	62 (60.2%)	63 (63.6%)	53 (50%)
Average age in years	22.66 ± 3.10 ^a	22.51 ± 3.25 ^c	22.65 ± 2.84 ^e	22.86 ± 3.22 ^g
FYPGPA	3.09 ± 0.47 ^b	3.03 ± 0.43 ^d	3.12 ± 0.52 ^f	3.15 ± 0.46 ^h
MSPGPA	3.24 ± 0.41	3.14 ± 0.46	3.28 ± 0.39	3.30 ± 0.34

FYPGPA = First year pharmacy Grade Point Average; MSPGPA = Math/Science Prepharmacy Grade Point Average.

^a1992-1994 classes, $P < 0.01$.

^c1992 Class, $P < 0.01$.

^e1993 Class, $P < 0.01$.

^g1994 Class, $P < 0.01$.

^b1992-1994 classes, $P < 0.01$.

^d1992 Class, $P < 0.01$.

^f1993 Class, $P < 0.01$.

^h1994 Class, $P < 0.01$.

Table III. Variables and significance

Variables	DF	Type	F value	P
		III SS		
MSPGPA	1	3.1367	21.85	0.0001
Degree	1	2.0801	14.49	0.0002
Class-Year	2	0.1506	0.52	0.5925
Age	1	0.1732	1.21	0.2728
MSPGPA X Degree	1	0.0399	0.28	0.5986
MSPGPA X Class-Year	2	0.2961	1.03	0.3577
MSPGPA X Age	1	0.0062	0.04	0.8354
Class-Year X Degree	2	0.1442	0.50	0.6061
Age X Degree	1	0.1150	0.80	0.3717
Age X Class-Year	2	0.1976	0.69	0.5034
MSPGPA X Class-Year				
X Degree	2	0.1024	0.36	0.7003
MSPGPA X Age X				
Class-Year	2	0.0524	0.18	0.8332
MSPGPA X Age X Degree	1	0.0425	0.30	0.5867
Age X Class-Year X Degree	2	0.4312	1.50	0.2248
MSPGPA X Age X Class-Year X Degree	2	0.2084	0.73	0.4847

MSPGPA = Math/Science Prepharmacy Grade Point Average.

study indicated that FYPGPA of students with prior four year college degrees were significantly better than FYPGPA of students without prior four year college degrees ($P < 0.01$). Furthermore, students with four year college degrees academically outperformed students without prior four year college degrees in each study year (1992, 1993, and 1994). Since students with four year college degrees tended to be older than students without prior degrees, it was important to determine whether it was age or degree status which influenced first year academic performance. Results confirmed that while the age of the degree and nondegree groups were significantly different ($P < 0.01$), age was not a significant predictive factor of academic performance. In order to defuse concern over multicollinearity between age and degree status, a Pearson correlation coefficient and a

Table IV. Model variable partial R-squares by year and overall for three year period

Variables	Overall (N=342)	1992 (N=120)	1993 (N=116)	1994 (N=106)
MSPGPA	0.2797	0.2231	0.2594	0.3910
Degree	0.0966	0.1208	0.0767	0.0889
Model	0.3763	0.3439	0.3361	0.4799

All values in the table are statistically significant ($P < 0.001$).

MSPGPA = Math/Science Prepharmacy Grade Point Average.

variance inflation factor was calculated. Tests indicated no significant problem due to collinearity between the two factors. Furthermore results clearly demonstrate that degree status, while controlling for existing age differences, was significantly associated with students' FYPGPA. Collectively, these findings support and validate the positive influence of a prior four year college degree to FYPGPA.

An interesting finding uncovered in this investigation is that although students with four year college degrees did not have significantly lower prepharmacy math/science GPA than students without degrees (See Table II), they did have significantly lower overall prepharmacy GPA (3.26 ± 0.29 , 3.38 ± 0.32 , $P < 0.05$). However, once in pharmacy school, students with degrees academically outperformed students without prior degrees during the first year. Perhaps the achievement of a four year degree as a significant factor predicting first year academic performance represents several variables that are reflected by the marker of a prior degree. For example, students with degrees may have a different perspective on professional education and careers; thus resulting in greater motivation for success. Although assessment of motivation and career goals are often subjective, achieving a prior degree may be an objective indicator of these factors. A question that remains is whether students with degrees perform better throughout the entire pharmacy curriculum, and ultimately result in better functioning professionals?

Since the first year of pharmacy school is the foundation of pharmacy education and because student withdrawal from our institution appears to be higher in the first year, we believe that it is important to identify factors that influence FYPGPA. In examining the students who did not complete the first year of pharmacy school at our institution due to withdrawal, none of these students had a prior four year college degree; supporting the positive influence of a four year degree on academic success. Limited data were available on the type of four year college degree obtained by the students and therefore no statistical analysis on degree type was performed.

Information generally used in selecting candidates for admission consist of students' academic transcripts and PCAT scores. Prepharmacy GPA and PCAT scores, although useful, are only two measurements of performance. There is a great need for valid, objective, consistent, and reliable factors that predict and influence pharmacy students' academic performance. The investigators believe that the curriculum of the specific pharmacy school has a tremendous impact on which admission variables are significant. With the implementation of a new curriculum at our institution, we are in the process of investigating which admission factors predict academic performance in this new setting. Could the significant factors identified in the past curriculum be different in the new curriculum? Are the significant factors identified in the past curriculum the same in the new curriculum? If results from other studies are similar to this study, perhaps pharmacy educators will consider placing emphasis on the achievement of obtaining a four year college degree in selecting students for admission.

CONCLUSION

Factors that influence pharmacy students' academic performance should be investigated and identified. This study demonstrated that students who have a four year college degree prior to entering pharmacy school had significantly

higher first-year pharmacy school grade point averages than students without a prior four year college degree. Although the results generated from this research are applicable only to the study institution, it serves as a starting point for future studies investigating prior four year college degree status and academic performance. Due to the implementation of the entry level Doctor of Pharmacy degree and revised curricula at pharmacy schools, future studies need to be conducted to determine the appropriateness and the utility of using degree status as an evaluative tool in the admission process. Based on the findings of this study, schools of pharmacy should consider the significance of achieving a prior four year college degree when evaluating candidates for admission.

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