Original Article

Utility of Noncognitive Admission Variables in the Prediction of Academic Success

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Abstract

Background

Physician Assistant (PA) programs commonly rely on cognitive measures such as grade point average for admission to their programs. Noncognitive measures are also collected at the time of application, with less information known about their utility in prediction of academic outcomes. This analysis observed the following noncognitive admission domains and their relationship with PA student academic success: employment hours, shadowing experience hours, research hours, hours spent in extracurricular activities, healthcare related activity hours, leadership experience, patient care experience hours, teaching hours, and volunteerism hours.

Objective

This archival analysis aims to determine if noncognitive admission variables are predictive of Physician Assistant National Certifying Examination (PANCE) failure or academic attrition at a West Texas PA Program.

Methods: A series of multiple logistic regression models were constructed to predict PANCE failure and attrition using applicant self-reported cumulative experience hours in the noncognitive admission domains. Five cohorts (n=235) were evaluated using R statistical software (version 4.1.2).

Results

Patient care experience hours demonstrated a positive association with PANCE failure, while healthcare experience had positive trends with attrition. High GPA was protective against attrition when controlled for employment, research, and shadowing experiences, and also when controlled for leadership and patient care experience. High GPA was not a protective factor for PANCE failures.

Conclusion

Contrary to our hypothesis, increased self-reported experiences did not show a protective effect against PANCE failure or attrition but were instead detrimental.

Keywords: admission, attrition, physician assistant, PANCE, West Texas, healthcare experience

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Background

Attrition and Physician Assistant National Certifying Examination (PANCE) failure are significant challenges for physician assistant (PA) programs. In 2019, the Physician Assistant Education Association Program Report identified a 93% graduation rate and an attrition rate of 6.7%.[1] The National Commission on Certification of Physician Assistants (NCCPA) reported a 95% national first-time PANCE pass rate in 2020, and a 93% first-time PANCE pass rate in 2019.[2] Furthermore, success on the PANCE and graduation rates are vitally important to PA programs because it has implications for accreditation, overall student success, and for PA candidate recruitment.[3-4] Attrition can also place financial strain on PA programs because the vacated seat often remains unreplaced.[3]

Attrition and first-time PANCE failure not only affect PA programs but can also have a lasting psychological impact on the PA student with one study describing it as an "emotional upheaval." [3] A student who is unable to complete the program is often left with unpaid student loans, loss of time spent actively employed, and an unlikely chance of ever realizing their goal of becoming a PA.[3] To decrease PA program attrition and PANCE failure, admission committees are tasked with identifying any variables in their applicant pool that may be predictive of academic outcomes. There has been much research considering cognitive variables at admission predicting academic outcomes; however, less analysis has been performed considering noncognitive variables.[4-5] Cognitive variables that have been researched for their utility in predicting academic outcomes include undergraduate grade point average (GPA) and Graduate Record Examination (GRE) scores;[3] however, increasingly the importance of holistic admission processes and placing a larger emphasis on noncognitive variables is gaining attention.[6]

Objective

Prior studies examining noncognitive variables before matriculation have focused on domains such as emotional intelligence[8-9] or prior healthcare experience.[6,10] PA programs often emphasize previous clinical experience before admission though there is little evidentary basis and at least one study specific to PA education found no association between previous clinical experience and academic outcomes.[12] There remains little research specific to PA students considering noncognitive variables and their utility in predicting academic outcomes. We hypothesize that noncognitive admissions variables in PA students could be predictive in reducing PA student attrition rates and first-time PANCE failure rates.

Methods

Institutional Review Board exemption was obtained to examine five cohorts of PA students from graduating class years 2017 to 2021 from one West Texas PA Program using total hours for nine noncognitive variables self-reported through the Centralized Application Service for Physician Assistants (CASPA). The admission demographics of the PA students for the cohorts examined are depicted in Table 1.

Table 1. GPA of attrition and PANCE failure of students by age

Students <25yo	
Total Attrition	1
Avg GPA Attrition	3.37
Total PANCE failures	8
Avg GOA PANCE failure	3.61
Students 25-29yo	
Total Attrition	8
Avg GPA Attrition	3.31
Total PANCE failures	7
Avg GOA PANCE failure	3.46
Students 30-35yo	
Total Attrition	1
Avg GPA Attrition	3.46
Total PANCE failures	0
Avg GOA PANCE failure	n/a
Students >35yo	
Total Attrition	3
Avg GPA Attrition	3.5
Total PANCE failures	3
Avg GOA PANCE failure	3.25

Data was examined by total cohort (n=235) and by students with below the program acceptance average total GPA of 3.5 (n=108) defined as a low GPA. The following nine variables were analyzed for their potential utility in predicting either attrition from the PA program or PANCE failure: employment hours, shadowing experience hours, research hours, hours spent in extracurricular activities, healthcare-related activity hours, leadership experience, patient care experience hours, teaching hours, and volunteerism hours. Only attrition for academic reasons was included and did not include students who decelerated or had attrition for medical or personal reasons.

The data was cleaned and analyzed using R statistical software (version 4.1.2). A series of multiple logistic regression models were constructed to predict PANCE failures and attrition using self-reported total experience hours in each of the nine noncognitive variable categories. Cumulative GPA was examined in two categories: those with GPA above and below the program average acceptance GPA of 3.5 on a 4.0 scale at the time of matriculation. Additional exploratory multiple logistic regression models were constructed to predict Attrition or PANCE failures using each of the self-reported noncognitive variables, GPA (i.e. High vs. Low), and their interaction. These multiple logistic regression models allowed us to examine the differential effects of non-cognitive variables in predicting Attrition and PANCE failures among applicants with high vs. low GPAs.

Results

With consideration of the full data set, self-reported cumulative healthcare experience hours positively predicted attrition (β = 0.0001; OR = 1.0001, p = 0.048). This indicates that every additional hour of increase in healthcare experience increased the odds of attrition by approximately 0.01%. In addition, cumulative exposure to patient care and cumulative duration of employment had positive statistical trends in predicting PANCE failures and attrition respectively (β = 0.0001, OR = 1.0001, p = 0.054 and β = 0.0001, OR = 1.0001 = 0.098 respectively). All other univariate logistic regression models were not statistically significant.

The data was analyzed with consideration of students with low GPA only. The average total GPA at the time of application through CASPA for all five cohorts was 3.54 and the average total science GPA at the time of application was 3.46. Among students with low GPA (less than 3.5 on a 4.0 scale), self-reported patient care experiences showed a statistical trend of being positively associated with PANCE failures (β = 0.0001; OR = 1.0001, p = 0.052). This data represented in Table 2 indicates that every additional hour of increase in patient experiences increased the odds of PANCE failure by 0.01%.

Table 2. Results of multiple logistic regression models predicting PANCE failures among students using self-reported cumulative experiences / exposures, pre-admission GPA and their interactions.

Model	Dependent Variable	Independent Variable	β	SE	z-statistic	p-value
1	PANCE Failures	Intercept	-3.1305	0.6687	-4.6811	<0.0001
		Employment	-0.0002	0.0003	-0.5834	0.5596
		High GPA	-1.0389	1.0726	-0.9685	0.3328
		Interaction	0.0002	0.0003	0.6211	0.5245
		N = 215, AIC = 54.289, log likelihood (df=2) = -23.145				
2	PANCE Failures	Intercept	-2.2435	0.6254	-3.5873	0.0003
		Extracurricular	-0.0039	0.0086	-0.4592	0.6461
		High GPA	-1.1275	1.0098	-1.1166	0.2642
		Interaction	0.0038	0.0086	0.4431	0.6577
		N = 106, AIC = 45.932, log likelihood (df=2) = -18.966				
3	PANCE Failures	Intercept	-3.1511	0.6625	-4.7561	<0.0001
		Healthcare Experience	-0.0003	0.0005	-0.5895	0.5555
		High GPA	0.3593	1.0391	0.3458	0.7295
		Interaction	-0.0156	0.0183	-0.8561	0.3919
		N = 215, AIC = 50.496, log likelihood (df=2) = -21.248				
4	PANCE Failures	Intercept	-1.9521	0.6910	-2.8252	0.0047
		Leadership	-0.0041	0.0046	-0.8936	0.3715
		High GPA	-1.5734	1.0758	-1.4626	0.1436
		Interaction	0.0042	0.0046	0.9219	0.3566
		N = 106, AIC = 45.424, log likelihood (df=2) = -18.712				
5	PANCE Failures	Intercept	-3.9911	0.7638	-5.2254	<0.0001
		Patient Care Experience	**0.0001**	**0.0001**	**1.9415**	**0.0522**
		High GPA	0.4321	1.1383	0.3796	0.7043
		Interaction	-0.0009	0.0011	-0.8014	0.4229
		N = 215, AIC = 51.3, log likelihood (df=2) = -21.65				
6	PANCE Failures	Intercept	-2.9087	0.5929	-4.9060	<0.0001
		Research	-0.8431	137.7127	-0.0061	0.9951
		High GPA	-0.7676	0.9296	-0.8257	0.4090
		Interaction	-0.0140	193.2997	-0.0001	0.9999
		N = 215, AIC = 50.368, log likelihood (df=2) = -21.184				
7	PANCE Failures	Intercept	-3.4590	0.6597	-5.2428	<0.0001
		Shadowing	0.0001	0.0008	0.1264	0.8994
		High GPA	-0.0642	1.2198	-0.0527	0.9580
		Interaction	-0.0042	0.0071	-0.5920	0.5538
		N = 215, AIC= 54.458, log likelihood (df=2) = -23.229				
8	PANCE Failures	Intercept	26.5661	90577.6039	-.0003	0.9998
		Teaching	0.0000	255.5565	0.0000	1.0000
		High GPA	0.0000	110250.0742	0.0000	1.0000
		Interaction	0.0000	353.5806	0.0000	1.0000
		N = 55, AIC = 8, log likelihood (df=2) = 0				
9	PANCE Failures	Intercept	-3.3964	0.6201	-5.4773	<0.0001
		Volunteerism	<0.0001	0.0003	-0.1186	0.9056
		High GPA	-0.7397	1.0149	-0.7289	0.4661
		Interaction	0.0001	0.0006	0.2124	0.8318
		N = 215, AIC = 54.935, log likelihood (df=2) = -23.467				

Table 3. Results of multiple logistic regression models predicting attrition among students using self-reported cumulative experiences / exposures, pre-admission GPA and their interactions.

Model	Dependent Variable	Independent Variable	β	SE	z-statistic	p-value
1	Attrition	Intercept	-2.2317	0.4213	-5.2973	<0.0001
		Employment	-0.0001	0.0001	-0.8762	0.3809
		High GPA	**-3.4674**	**1.3992**	**-2.4782**	**0.0132**
		Interaction	**0.0003**	**0.0002**	**1.9068**	**0.0565**
		N = 235, AIC = 74.156, log likelihood (df=2) = -33.078				
2	Attrition	Intercept	-2.2745	0.5557	-4.0933	<0.0001
		Extracurricular	-0.0003	0.0008	-0.3919	0.6951
		High GPA	-2.0304	1.2719	-1.15975	0.1102
		Interaction	0.0004	0.0011	0.3655	0.7148
		N = 118, AIC = 45.635, log likelihood (df=2) = -18.817				
3	Attrition	Intercept	-2.7276	0.4129	-6.6063	<0.0001
		Healthcare Experience	**0.0001**	**0.0001**	**1.6472**	**0.0995**
		High GPA	-1.4724	0.9079	-1.6218	0.1048
		Interaction	-0.0001	0.0003	-0.2194	0.8263
		N = 235, AIC = 82.552 log likelihood (df=2) = -37.276				
4	Attrition	Intercept	-2.1352	0.6046	-3.5314	0.0004
		Leadership	-0.0010	0.0016	-0.5910	0.5545
		High GPA	**-3.4178**	**1.9137**	**-1.7860**	**0.0741**
		Interaction	0.0020	0.0017	1.1383	0.2550
		N = 118, AIC = 42.896, log likelihood (df=2) = -17.448				
5	Attrition	Intercept	-2.5680	0.4318	-5.9469	<0.0001
		Patient Care Experience	0.0000	0.0001	0.3481	0.7278
		High GPA	**-1.5977**	**0.9396**	**-1.7004**	**0.0890**
		Interaction	0.0000	0.0003	-0.7047	0.9404
		N = 235, AIC = 85.124, log likelihood (df=2) = -38.562				
6	Attrition	Intercept	-2.4961	0.3818	-6.5384	<0.0001
		Research	0.0000	0.0003	0.0085	0.9932
		High GPA	**-1.6576**	**0.8245**	**-2.0104**	**0.0444**
		Interaction	<0.0001	0.0007	-0.0310	0.9753
		N = 235, AIC = 85.232, log likelihood (df=2) = -38.616				
7	Attrition	Intercept	-2.3035	0.4473	-5.1502	<0.0001
		Shadowing	-0.0008	0.0014	-0.5983	0.9932
		High GPA	**-1.6576**	**0.8245**	**-2.0104**	**0.0444**
		Interaction	**0.0035**	**0.0021**	**1.7066**	**0.0879**
		N = 235, AIC= 82.334, log likelihood (df=2) = -37.167				
8	Attrition	Intercept	-3.2243	1.1479	-2.8088	0.0050
		Teaching	**0.0021**	**0.0013**	**1.6718**	**0.0946**
		High GPA	-18.3418	4977.4328	-0.0037	0.9971
		Interaction	-0.0021	2.7407	-0.0008	0.9994
		N = 58, AIC = 18.547, log likelihood (df=2) = -5.274				
9	Attrition	Intercept	-2.4387	0.04014	-6.0750	<0.0001
		Volunteerism	-0.0001	0.0003	-0.2963	0.7670
		High GPA	-1.2947	1.0084	-1.2840	0.1992
		Interaction	-0.0011	0.0024	-0.4713	0.6374
		N = 235, AIC = 84.588, log likelihood (df=2) = -38.294				

Similarly, self-reported cumulative healthcare and teaching experiences had positive trends of being associated with attrition among students with low gpas (β = 0.0001; OR = 1.0001, p = 0.099 and β = 0.0021; OR = 1.0021, p = 0.095 respectively), indicating that per hour increase of health care and teaching experiences, the odds of failure among students with low gpas increased by 0.01% and 0.21% respectively. High GPA was a significant protective factor against attrition when controlled for employment, research, and shadowing experiences ($P < 0.05$) and also showed protective trends against attrition when controlled for leadership and patient care experiences ($P < 0.1$) but did not emerge as a protective factor for PANCE failures ($P > 0.1$). The attrition statistical analysis is listed in Table 3. None of the models revealed protective effects for self-reported experiences against PANCE failure or attrition.

Conclusion

Contrary to our hypotheses, increased self-reported experiences prior to matriculation into a PA program did not show a protective effect against PANCE failures or attrition but were detrimental. Taken together, prior employment hours, healthcare experience, leadership experience, research experience hours, or teaching experience hours at the time of admission are unlikely to be of value in predicting attrition and PANCE failures among PA students. In addition, a high GPA and increased reported noncognitive experience showed negative trends. These suggested that increased experience hours in the various domains may increase the risk of attrition among high GPA students to a greater extent than low GPA students. This suggests that if a student has a high GPA, but has stayed out of an academic setting for a long while, though their experience hours have increased, their risk of attrition is higher. Table 4 shows attrition events grouped by age range.

Table 4. Cumulative results of variables across multiple cohorts

Year	2017	2018	2019	2020	2021
Students per Cohort	55	58	58	58	60
Age at Matriculation	35.6	25.9	26.8	25.1	26.1
Gender	15(M) 40(F)	16(M) 42(F)	13(M) 45(F)	5(M) 53(F)	18(M) 42(F)
Average GPA	3.56	3.5	3.53	3.55	3.56
Average Science GPA	3.43	3.46	3.47	3.43	3.46
Average Patient Care Hours	1805	1585	1530	1254	2892

Our study did demonstrate that GPA is a significant predictor of protection from both attrition and PANCE failure. The finding that GPA is a strong predictor of academic success has been demonstrated in other studies.[3,6,11] However, some of these same referenced studies' analyses revealed an opposite finding from this analysis that previous healthcare experience was positively associated with higher PANCE scores.[3,6] There are previous analyses that are consistent with our findings that healthcare experience prior to matriculation is unlikely to be a significant predictor of academic outcomes.[12] Due to the discrepancies in the literature, there is a clear need for continued research evaluating noncognitive variables at the time of admission such as healthcare experience while controlling for further variables such as age at admission and specifics of the type of prior healthcare experience rather than a total quantifiable amount.

This study has several limitations. First, the noncognitive variables are self-reported

experience hours by applicants and are not verified by CASPA. Additionally, the only outcome measures were attrition for academic reasons and PANCE failure. Further analyses could be performed to include variables such as decelerations and attrition for personal reasons. Our secondary analysis had a few limitations. Even though we detected significant associations between prior employment hours, healthcare experience, leadership experience, research experience hours, teaching experience hours, and PANCE failures, the observed odds ratios were very close to 1. Furthermore, due to the small sample size, we did not attempt to adjust for the false discovery rate despite testing multiple closely related hypotheses using the same dataset. A final limitation is that the reported healthcare experience hours were not examined separately for differing professions but rather analyzed as total hours spent in any patient contact role. Moreover, this analysis uses only hours to reflect the complex life experiences of students and presupposes the question of whether the way that information is collected for noncognitive variables at the time of application is the most effective means.

This analysis has the strength of having a larger sample size than many of the previous similar analyses examining noncognitive variables at the time of admission. Also, to the best of our knowledge, this study is unique in that it examines previously unexamined domains such as volunteer hours, leadership experience, extracurricular activity hours, and teaching experience. This study was free of bias as quantified variables in the form of hours were used to perform the data analysis to assess the basic outcome measures of PANCE failure and attrition with all students from five cohorts included in the data set.

While healthcare experience hours specifically have been anecdotally weighted as important for success in allied health programs, this analysis did not support that assertion. Nonetheless, noncognitive admission variables are an important part of the screening process for applicants to PA programs as they can be predictive of other important traits such as emotional intelligence[8-9] which are required for success in physician assistant programs and this archival data analysis is not suggestive of the need for elimination of these variables from the selection process.

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