

Exam Master PA-CAT
PANCE, Clinical GPA, & PACKRAT 2 Data Analysis Report
(data received July 2021)
(examinees who were administered versions 1.0, 1.1, 1.2 & 2.0 of PA-CAT)

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Executive Summary

Scaled scores of 542 examinees who were administered versions 1.0, 1.1, 1.2, and v2.0 of PA-CAT were estimated using the Rasch Model in Winsteps 4.3.4. Mean PA-CAT scaled score was 503.3 and the standard deviation was 20.1. Mean and standard deviation of the clinical GPA were 3.68 and 0.27, respectively. Mean PANCE score was 474.1 with a standard deviation of 78.0. Mean PACKRAT 2 score was 152.4 with a standard deviation of 20.2.

Reliability of PA-CAT scaled scores

Estimated reliability of the overall PA-CAT scaled scores for the current sample of examinees is good at 0.83. Estimated reliability coefficients of the three subject group scaled scores are: Subject Group 1 (Anatomy and Physiology, reliability=0.67); Subject Group 2 (General Biology, Microbiology, and Genetics, reliability =0.67), and Subject Group 3 (General Chemistry, Organic Chemistry, and Biochemistry, reliability =0.45). If reliability of scaled scores is low (<0.80), their correlation coefficients with Clinical data will be attenuated.

Relationship between PA-CAT scaled scores, Clinical GPA, PANCE scores, PACKRAT 2 scores, undergraduate GPA, and undergraduate Science GPA

PA-CAT scaled scores have a medium or close to medium positive correlation with all three outcome variables: Clinical GPA ($r=0.29$), PANCE scores ($r=0.38$), and PACKRAT 2 scores ($r=0.30$). Correlation of the subject-group scaled scores with the three outcome variables range from very small (0.15) to medium (0.38). Correlation of the admissions variables (undergraduate GPA and undergraduate science GPA) with the three outcome variables is very small (0.11) to medium (0.32) or not statistically significant in one case. All correlation coefficients are reported in Table 5.

Value of PA-CAT scaled scores, undergraduate GPA, and undergraduate science GPA in predicting PANCE scores, Clinical GPA, and PACKRAT 2 scores

PA-CAT scaled scores explain about 14.8% of the variance in PANCE scores. Undergraduate GPA and undergraduate science GPA add some value to the prediction of PANCE scores beyond PA-CAT scaled scores. The three predictor variables together explain about 21.8% of the variance in PANCE scores.

PA-CAT scaled scores explain about 8.3% of the variance in clinical GPA. Undergraduate GPA and undergraduate science GPA do not add much value to the prediction of clinical GPA beyond PA-CAT scaled scores. The three predictor variables together explain about 9.0% of the variance in Clinical GPA.

PA-CAT scaled scores explain about 9.0% of the variance in PACKRAT 2 scores. Undergraduate GPA and undergraduate science GPA do not add much value to the prediction of clinical GPA beyond PA-CAT scaled scores. The three predictor variables together explain about 11.7% of the variance in PACKRAT 2 scores.

Limitations

These findings are based on a small sample of PA programs and may not be generalizable to all PA programs. Moreover, the sample size is small in some cases and the results could be meaningfully different when more clinical GPA, PANCE, and PACKRAT 2 data is received in future. Another limitation is that the analysis of clinical GPA, PANCE scores, and PACKRAT 2 scores are based on different samples. Lastly, reliability of subject-group-level scaled scores is not desirably high which results in attenuated correlation coefficient.

1. Scaled Scores

Item measures were estimated using Winsteps 4.3.4 using data from versions 1, 1.1, 1.2, 1.3, and 2.0 of PA-CAT. Person measures were estimated using data from versions 1, 1.1, 1.2, and 2.0. The estimates yielded by Rasch analysis are in logits which are positive and negative numbers with decimals. These estimates were scaled to have a mean item measure of 500 for the items comprising version 2.0 to ensure that there are no negative scaled scores. A spacing factor of 50 was used to ensure that the integer scaled scores without decimals do not leave behind any information that may be useful in identifying individual difference amongst persons and items (Wright & Stone, 1979). Scaled scores are a linear transformation of the logit estimates using the following equation:

$$\text{Scaled score} = 500 + 50 * \text{logit estimate}$$

One logit on the original metric is equal to 50 scaled score units in the transformed estimates. Scaled scores for PA-CAT are reported on a scale of 200 to 800. Any estimated value lower than 200 or higher than 800 is reported as 200 and 800, respectively.

2. Descriptive Analysis

PANCE and PA-CAT scaled scores were available for 399 examinees. Numeric clinical GPA and PA-CAT scaled scores were available for 400 examinees. Clinical GPA was reported as 'Pass' for 62 examinees and these were excluded from all analyses. PACKRAT 2 and PA-CAT scaled scores were available for 409 examinees. There were 191 examinees for whom all three outcome variable data (PANCE scores, numeric clinical GPA, and PACKRAT 2) were available.

For the current report, clinical GPA analysis included all examinees for whom numeric clinical GPA was available, the PANCE score analysis included all examinees for whom PANCE scores were available, and the PACKRAT 2 score analysis included all examinees for whom PACKRAT 2 scores were available. The reason for this choice is that more data is expected in future and maximum of the currently available data is used to inform the research committee. When more data becomes available in future, analysis will be conducted where all three outcome variable data is available to be able to make comparison of relationship of PA-CAT with all three outcome variables.

The total sample comprised of 543 examinees for whom either PANCE score or clinical GPA or PACKRAT 2 score was available. PA-CAT scores were not available for one examinee since the ExamineeID was not in the database. Number of examinees that were administered each version of the exam are reported in Table 1 below.

Table 1: Frequency of examinees administered each version

Version	Frequency	Percent
v1.0	82	15.1
v1.1	207	38.1
v1.2	182	33.5
v2.0	72	13.3
Total	543	100.0

Gender of the examinees is reported in Table 2 below. Gender was missing for one examinee.

Table 2: Number of examinees by gender

		n	Percent
Gender	Male	152	28.0
	Female	390	72.0
	Total	542	100.0

Descriptive statistics for scaled scores, Clinical GPA, PANCE scores, and PACKRAT 2 scores are reported in Table 3.

Table 3: Descriptive statistics (scaled scores, Clinical GPA, PANCE score, PACKRAT 2)

		Scaled Score	Clinical GPA	PANCE	PACKRAT 2
Mean		503.3	3.68	474.1	152.4
SD		20.1	0.27	78.0	20.2
Median		503.0	3.75	471.0	152.0
Percentiles	5	470	3.15	354	121
	25	490	3.50	414	140
	75	516	3.91	523	166
	95	538	4.00	606	186
Minimum		425	2.88	284	65
Maximum		561	4.00	782	204

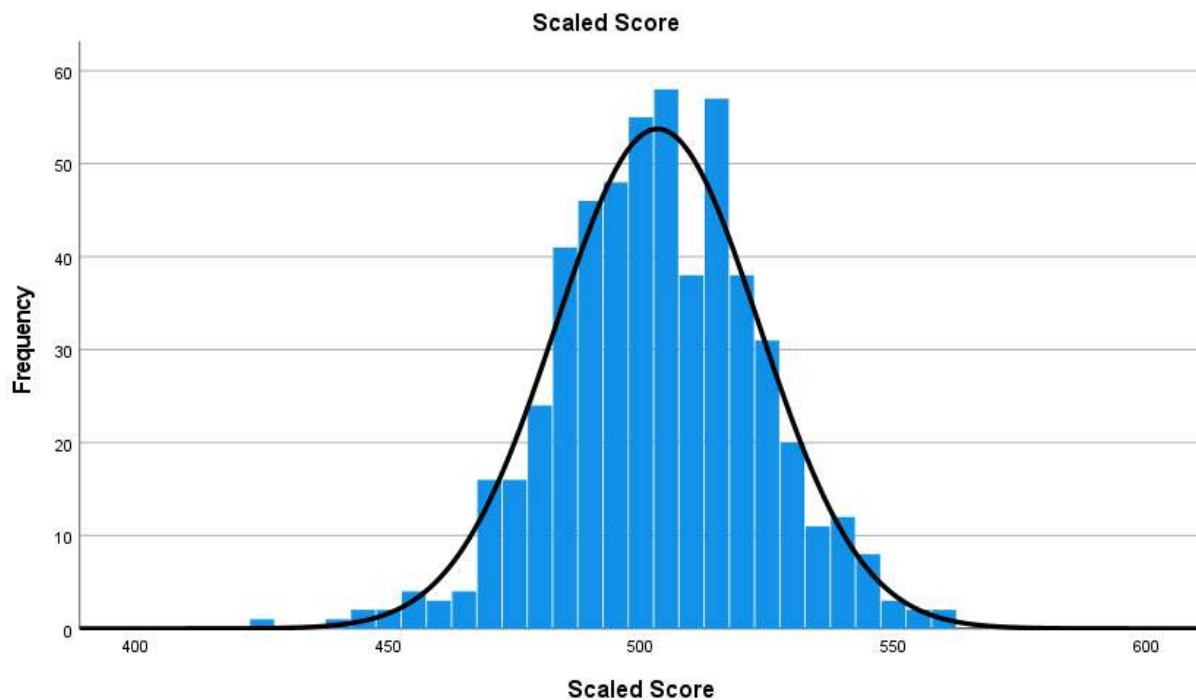


Figure 1: Distribution of scaled scores

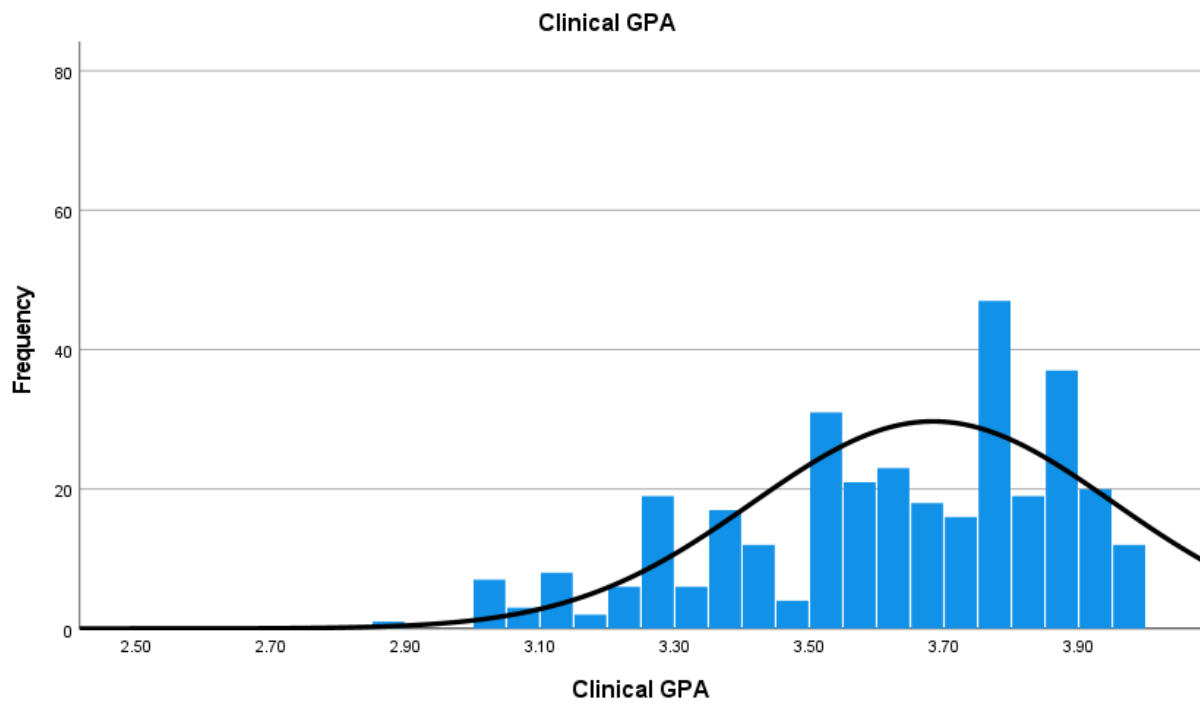


Figure 2: Distribution of Clinical GPA

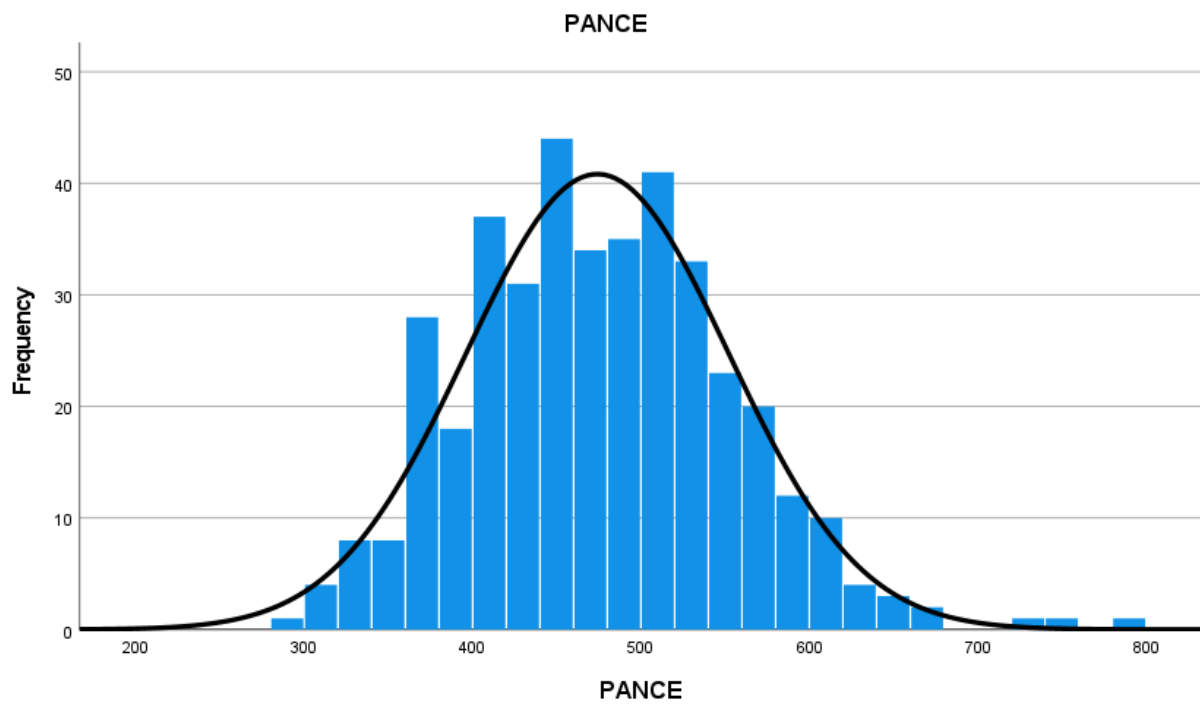


Figure 3: Distribution of PANCE scores

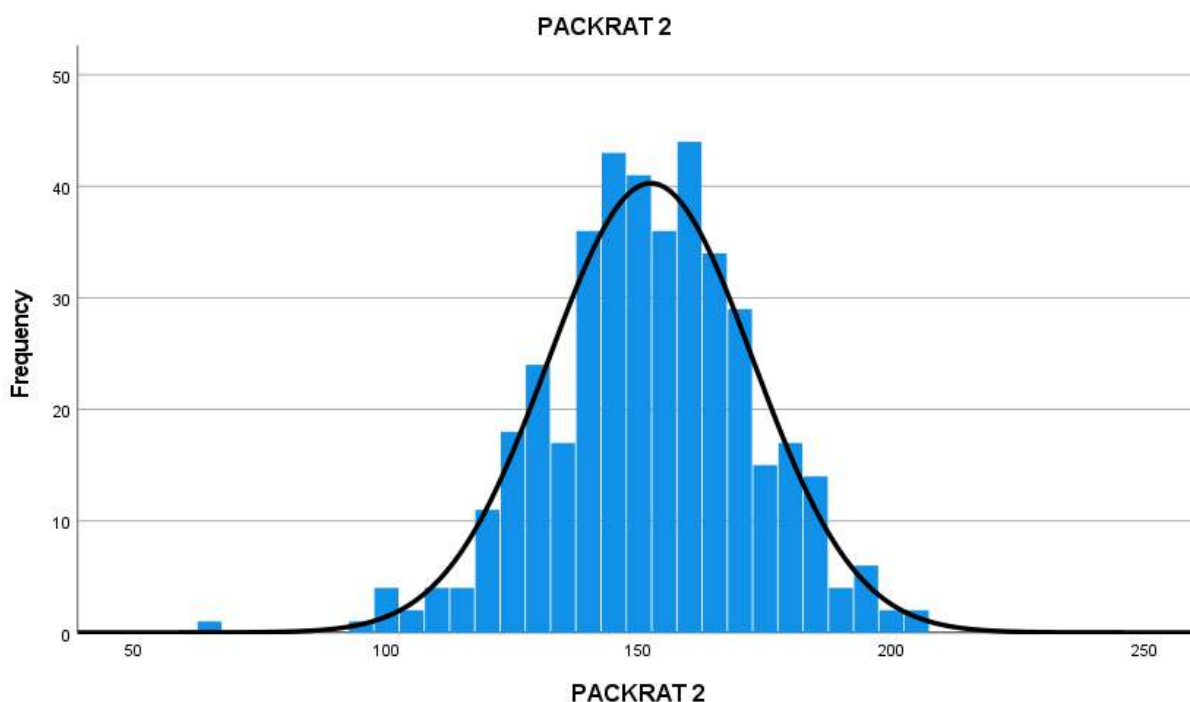


Figure 4: Distribution of PACKRAT 2 scores

3. Reliability of scaled scores

Person measure reliability can be interpreted as a traditional reliability index with values close to 1 indicating more internally consistent measures. Estimated reliability coefficients of the overall scaled scores and subject-group-level scaled scores are presented in Table 4 below. Please note that this is just an estimate of reliability since actual reliability could not be computed in Winsteps due to missing ExamineeIDs for some examinees in the clinical data. Reliability of scaled scores reported in this table may be different from the numbers reported in other reports because reliability is sample dependent.

Reliability of the overall exam is good at 0.83. It is important to note that for predictive validity analysis, achieving good reliability of measures (>0.80) is particularly important to be able to accurately estimate the correlation of subject-group-level measures with examinees' academic performance in the Physician Assistant program. If reliability of measures is low, correlation coefficients will be attenuated.

Table 4: Reliability of scaled scores

	Reliability of scaled scores*
All items (PA-CAT)	0.83
Subject Group 1: Anatomy, Physiology	0.67
Subject Group 2: General Biology, Microbiology, and Genetics	0.67
Subject Group 3: General Chemistry, Organic Chemistry, Biochemistry	0.45
*Estimate of reliability since actual reliability could not be computed in Winsteps due to missing ExamineeIDs for some examinees in the Clinical data	

4. Relationship between PA-CAT scaled scores, Clinical GPA, PANCE scores, undergraduate GPA, and undergraduate science GPA

Pearson correlation coefficients between PA-CAT scaled scores, clinical GPA, PANCE scores, PACKRAT 2 scores, undergraduate GPA, and undergraduate science GPA are reported in Table 5. Clinical GPA has a close to medium-sized positive correlation with overall PA-CAT scaled scores ($r=0.29$) and a very small correlation with undergraduate GPA ($r=0.14$) and undergraduate science GPA ($r=0.11$). Clinical GPA has a very small to medium-sized positive correlation (0.15 to 0.35) with the subject-group scaled scores.

Table 5: Correlation between Clinical GPA, PANCE scores, PA-CAT scaled scores, undergraduate GPA, and undergraduate science GPA

	Clinical GPA	PANCE	PACKRAT 2
Clinical GPA	1		
PANCE	0.44**	1	
PACKRAT 2	0.55**	0.60**	1
Scaled Score: PA-CAT	0.29**	0.38**	0.30**
Scaled Score: Subject Group 1 (Anatomy and Physiology)	0.35**	0.32**	0.28**
Scaled Score: Subject Group 2 (General Biology, Microbiology, and Genetics)	0.18**	0.38**	0.26**
Scaled Score: Subject Group 3 (General Chemistry, Organic Chemistry, and Biochemistry)	0.15**	0.23**	0.19**
GPA-Undergraduate	0.14**	0.32**	0.10*
GPA-Undergraduate Science	0.11*	0.22**	0.00
<p>** Correlation is significant at the 0.01 level (2-tailed).</p> <p>* Correlation is significant at the 0.05 level (2-tailed).</p> <p>Correlation between clinical GPA and PANCE scores is based on 258 examinees.</p> <p>Correlation between clinical GPA and PACKRAT 2 scores is based on 330 examinees.</p> <p>Correlation between PANCE and PACKRAT 2 scores is based on 267 examinees.</p> <p>Correlation coefficients for clinical GPA are based on 398 to 400 examinees except for the correlation with PANCE and PACKRAT 2 scores.</p> <p>Correlation coefficients for PANCE scores are based on 399 examinees except for the correlation with clinical GPA and PACKRAT 2 scores.</p> <p>Correlation coefficients for PACKRAT 2 scores are based on 407 to 409 examinees except for the correlation with clinical GPA and PANCE scores.</p>			

PANCE scores are correlated positively with PA-CAT scaled scores ($r=0.38$), subject group 1 scaled scores ($r=0.32$), subject group 2 scaled scores ($r=0.38$), subject group 3 scaled scores ($r=0.23$), undergraduate GPA ($r=0.32$), and undergraduate science GPA ($r=0.22$).

PACKRAT 2 scores have a positive correlation with overall PA-CAT scaled scores ($r=0.30$), subject group 1 scaled scores ($r=0.28$), and subject group 2 scaled scores ($r=0.26$). PACKRAT 2 scores have a very small positive correlation with subject group 3 scaled scores ($r=0.19$) undergraduate GPA ($r=0.10$, $p<0.05$) and negligible correlation undergraduate science GPA ($r=0.00$).

5. Value of PA-CAT, Undergraduate GPA, and Undergraduate Science GPA in Predicting PANCE scores

Four sets of regression analyses were conducted to assess the predictive validity of PA-CAT scaled scores, undergraduate GPA and undergraduate science GPA:

- 1) PA-CAT scaled score as the only predictor of PANCE scores;
- 2) Undergraduate GPA as the only predictor of PANCE scores;
- 3) Undergraduate science GPA as the only predictor of PANCE scores;
- 4) PA-CAT scaled scores, undergraduate GPA, and undergraduate science GPA as predictors of PANCE scores.

Table 6: Value of PA-CAT, undergraduate GPA, and undergraduate science GPA in predicting PANCE scores

Correlation between PANCE scores and:	Correlation Coefficient	% of variance in PANCE scores explained:
PA-CAT scaled scores	0.38	14.8
Undergraduate GPA	0.32	9.9
Undergraduate science GPA	0.22	4.7
PA-CAT scaled scores, Undergraduate GPA, Undergraduate science GPA	0.47	21.8

Correlation between PA-CAT scaled scores and PANCE scores is medium ($r=0.38$). PA-CAT scaled scores explain a greater proportion of variance in PANCE scores as compared to undergraduate GPA and undergraduate science GPA (Table 6). In other words, PA-CAT scaled scores provided a stronger prediction of PANCE scores as compared to the other two variables. When undergraduate GPA and undergraduate science GPA are added as predictor variables to the model with PA-CAT scaled scores, the prediction of PANCE scores improves (21.8% of variance explained vs 14.8% of variance explained).

6. Value of PA-CAT, Undergraduate GPA, and Undergraduate Science GPA in Predicting Clinical GPA

Four sets of regression analyses were conducted to assess the predictive validity of PA-CAT scaled scores, undergraduate GPA and undergraduate science GPA:

- 1) PA-CAT scaled score as the only predictor of Clinical GPA;
- 2) Undergraduate GPA as the only predictor of Clinical GPA;
- 3) Undergraduate science GPA as the only predictor of Clinical GPA;
- 4) PA-CAT scaled scores, undergraduate GPA, and undergraduate science GPA as predictors of Clinical GPA.

Table 7: Value of PA-CAT, undergraduate GPA, and undergraduate science GPA in predicting Clinical GPA

Correlation between Clinical GPA and:	Correlation Coefficient	% of variance in Clinical GPA explained:
PA-CAT scaled scores	0.29	8.3
Undergraduate GPA	0.14	2.0
Undergraduate science GPA	0.11	1.1
PA-CAT scaled scores, Undergraduate GPA, Undergraduate science GPA	0.30	9.0

Correlation between PA-CAT scaled scores and Clinical GPA is close to medium ($r=0.29$). PA-CAT scaled scores explain a higher proportion of variance in Clinical GPA (8.3%) as compared to undergraduate GPA (2.0%) and undergraduate science GPA (1.1%) (Table 7). In other words, PA-CAT scaled scores provided a relatively stronger prediction of Clinical GPA as compared to the other two variables. When undergraduate GPA and undergraduate science GPA are added to the model with PA-CAT scaled scores, the prediction of PANCE scores does not improve much (9.0% of variance explained vs 8.3% of the variance explained).

7. Value of PA-CAT, Undergraduate GPA, and Undergraduate Science GPA in Predicting PACKRAT 2 scores

Four sets of regression analyses were conducted to assess the predictive validity of PA-CAT scaled scores, undergraduate GPA and undergraduate science GPA:

- 1) PA-CAT scaled score as the only predictor of PACKRAT 2 scores;
- 2) Undergraduate GPA as the only predictor of PACKRAT 2 scores;
- 3) Undergraduate science GPA as the only predictor of PACKRAT 2 scores;
- 4) PA-CAT scaled scores, undergraduate GPA, and undergraduate science GPA as predictors of PACKRAT 2 scores.

Table 8: Value of PA-CAT, undergraduate GPA, and undergraduate science GPA in predicting PACKRAT 2 scores

Correlation between PACKRAT 2 scores and:	Correlation Coefficient	% of variance in PACKRAT 2 scores explained:
PA-CAT scaled scores	0.30	9.0
Undergraduate GPA	0.10	1.0
Undergraduate science GPA	0.00	0.0
PA-CAT scaled scores, Undergraduate GPA, Undergraduate science GPA	0.34	11.7

Correlation between PA-CAT scaled scores and PACKRAT 2 scores is medium ($r=0.30$). PA-CAT scaled scores explain a higher proportion of variance in PACKRAT 2 scores (9.0%) as compared to undergraduate GPA (1.0%) and undergraduate science GPA (0.0%) (Table 8). In other words, PA-CAT scaled scores provided a relatively stronger prediction of PACKRAT 2 scores as compared to the other two variables. When undergraduate GPA and undergraduate science GPA are added to the model with PA-CAT scaled scores, the prediction of PANCE scores does not improve much (11.7% of variance explained vs 9.0% of the variance explained).

8. Mean PA-CAT Scaled Scores by PANCE Scores

Mean PA-CAT scaled scores by PANCE scores score range are reported in Table 9 and Figure 5. This is based on 399 examinees for whom both PANCE scores and PA-CAT scaled scores were available.

Table 9: Mean PA-CAT Scaled Score by PANCE scores

PANCE scores	Mean PA-CAT Scaled Score	% of Examinees
350 or below	478	4.8%
351-400	498	12.3%
401-450	502	21.1%
451-500	499	25.3%
501-550	508	20.8%
551-600	509	10.3%
601 or higher	529	5.5%

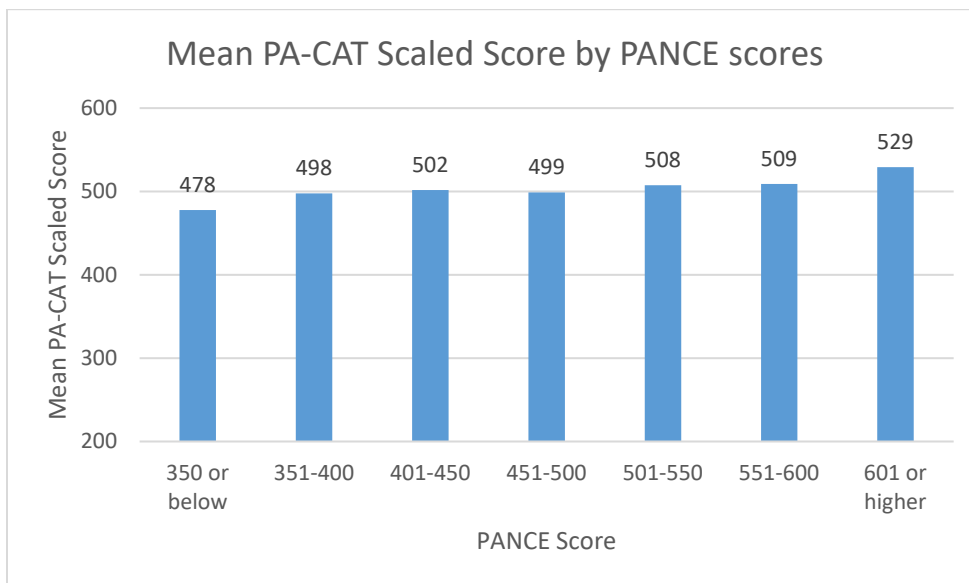
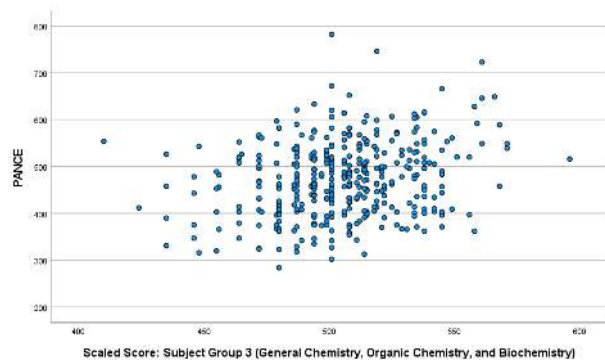
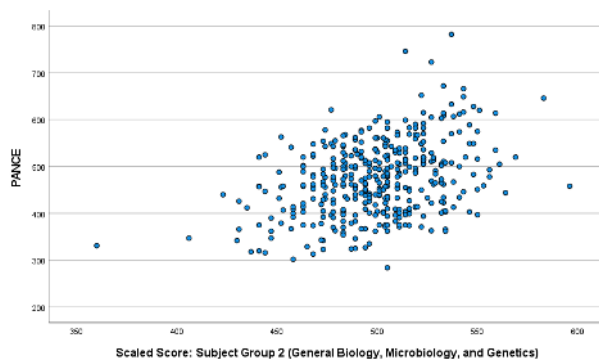
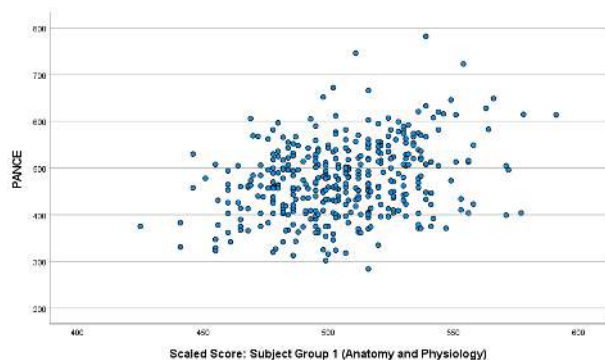
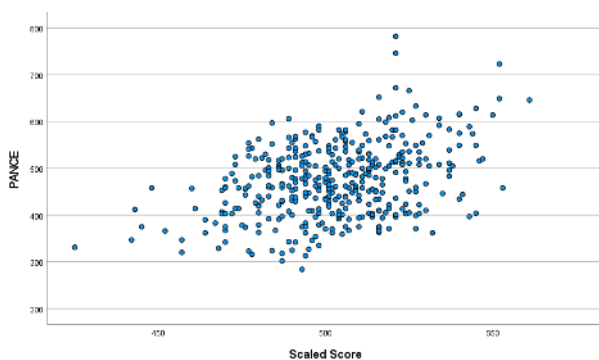


Figure 5: Mean PA-CAT scaled scores by PANCE scores

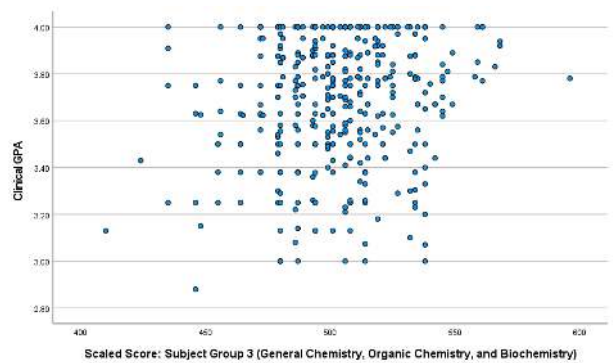
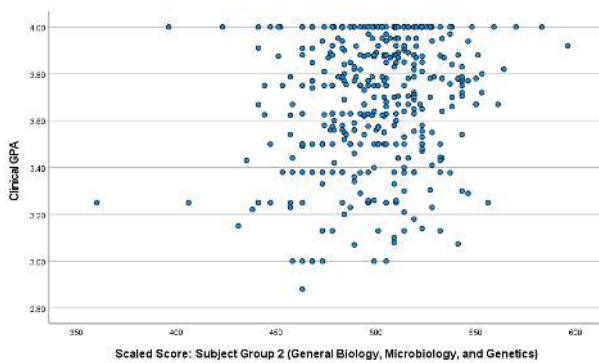
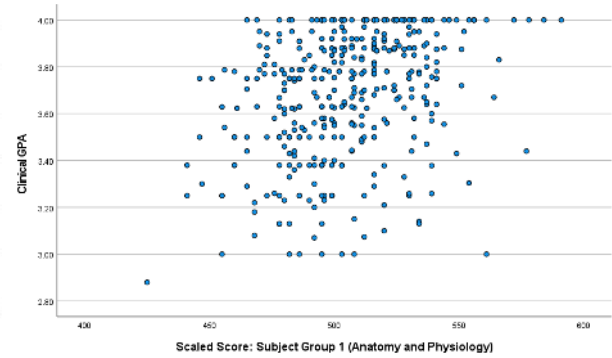
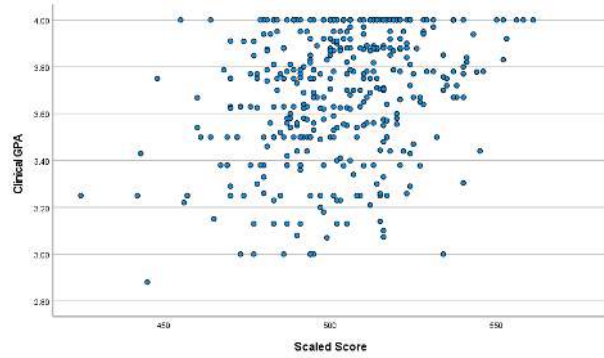
9. Limitations

These findings are based on a small sample of PA programs and may not be generalizable to all PA programs. Moreover, the sample size is small in some cases and the results could be meaningfully different when more clinical GPA, PANCE, and PACKRAT 2 data is received in future. Another limitation is that the analysis of clinical GPA, PANCE scores, and PACKRAT 2 scores are based on different samples. Reliability of subject-group-level scaled scores is not desirably high which results in attenuated correlation coefficient.

Appendix A: PANCE Score Scatter Plots



Appendix B: Clinical GPA Scatter Plots



Appendix C: PACKAT 2 Score Scatter Plots

