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Can We Find Pharmaceutical Calculations Low Performers Before Class Starts?: Identifying Problem Solving Deficiencies

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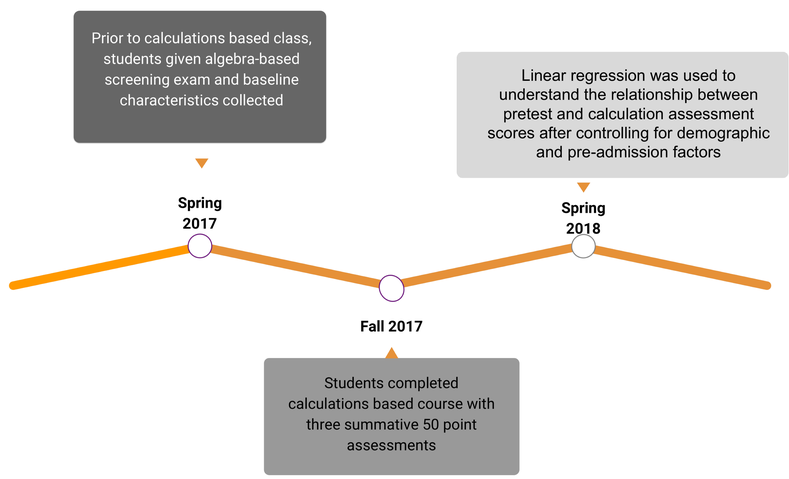
BACKGROUND

- Recent increases in deficient pharmaceutical calculations grades have prompted internal reflection
- Our experiences suggest some current students have difficulty applying problem solving skills to simple algebra-based word problems
- Previous research suggests success in calculation courses is related to undergraduate GPA and PCAT scores,[1,2] as well as time since and level of previous math exposure[2]
- Research is lacking as to what factors are related to calculations success for direct-entry students
- One older study was located that linked a basic math test to success in a calculations course[1], but the assessment used was not published

OBJECTIVES

- To determine the relationship between an algebra-based word problem pretest and pharmaceutical calculations performance to identify those at risk of low performance

METHODS



Sample
- Student pharmacists from the College of Pharmacy at Ohio Northern University, a 0-6 direct-entry program

Procedure
- First year students were given an 18 item pretest during spring semester
- The pretest contained algebraic word problems assessing percent, proportional reasoning, and unit analysis
- Prior to the pretest, students were asked to provide informed consent
- During the fall semester of their second year, those students completed a course containing pharmaceutical calculations content, containing three 50-point summative assessments
- Preadmission demographic characteristics were collected from student records
- This study was deemed exempt from full IRB review

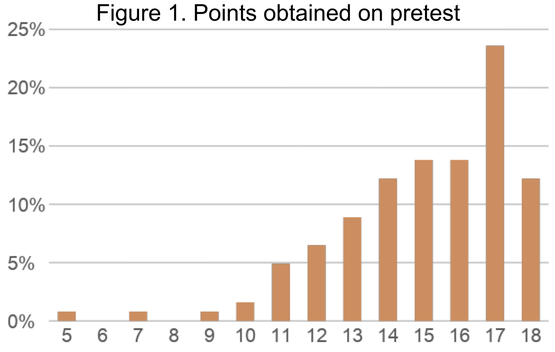
Analysis
- Pretest scores were compared with the calculations assessments
- Linear regression was used to understand the relationship between pretest and calculation assessment scores after controlling for demographic and pre-admission factors

RESULTS

Preadmission Demographics
- Out of 123 students completing both courses, 118 provided consent for this study
- The mean age of participants was 19.69
- Female was listed as gender for 62.7%
- The mean ACT score was 26.53
- The mean high school GPA was 3.99

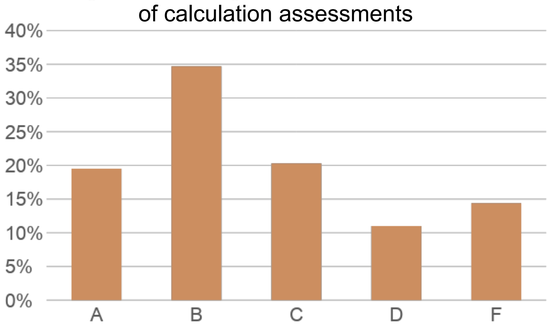
Pretest Performance
- Figure 1 shows the distribution of pretest scores
- The mean score was 15/18 (83.3%), ranging from 5 (27.8%) to 18 (100%)

Figure 1. Points obtained on pretest



Calculations Assessments
- Figure 2 shows the distribution of letter grades obtained from all calculations assessments, of which the mean was 115.7 / 150 (77.1%)

Figure 2. Letter grade obtained from sum of calculation assessments



Correlations and Linear Regression
- Table 1 shows correlations between select study variables, and Table 2 shows a linear regression model for calculations sum scores

Cutoff Scores
- Table 3 explores parameters of various pretest cutoff to predict passing pharmaceutical calculations assessments (i.e., >70%)

Table 1. Correlations between select study variables

	1.	2.
1. Calculations sum score	1	
2. Pretest score	.413*	1
3. Age	.009	-.009
4. Gender (1 = female)	-.025	-.008
5. High school GPA	.214*	.134
6. ACT math sub-score	.517*	.387*
7. ACT science sub-score	.421*	.278*
8. ACT English sub-score	.392*	.246*

* $p < .05$; listwise n = 105

Table 2. Linear regression for calculations sum score

	β	*p*
Constant		.582
Pretest score	.241	.008
Age	.038	.650
Gender (1 = female)	-.011	.901
High school GPA	.016	.864
ACT math sub-score	.302	.013
ACT science sub-score	.072	.559
ACT English sub-score	.135	.218

* $p < .05$; listwise n = 105; model adjusted $r^2 = .295$

Table 3. Possible cutoff criteria and respective parameters

	Sensitivity	Specificity	Accuracy
Less than 100% on pretest	1.00	.170	.381
Less than 90% on pretest	.833	.420	.525
Less than 80% on pretest	.633	.727	.703
Less than 70% on pretest	.333	.898	.754
Either #3 or #7 incorrect	.733	.750	.746

IMPLICATIONS

- After controlling for age, gender, earlier academic performance, and standardized test scores, an algebra-based word problem pretest was associated with performance on later pharmaceutical calculations assessments
- Although the pretest is associated with calculations performance, there is no perfect cutoff using the pretest alone (i.e., sacrificing sensitivity for specificity or vice versa depending on criteria)
- The next step in this line of inquiry is to determine how to reduce this deficit through deliberate supplementary content and structured problem solving activities for those in need

REFERENCES

1. Latif DA. 2002. The relationship among pharmacy students' basic math scores, traditional preadmission indicators, and performance in a pharmaceutical calculations course, *J Pharm Teach*, 10(1):17-29.

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