An Assessment of Incoming Pharmacy Students Reveals Math Deficiencies

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Highlights

- The baseline math assessment (BMA) revealed a range of math proficiency among incoming pharmacy students (Figure 1).
- Students struggle most with percentage problems, conversions, and problems that combine mathematical skills (Table 2).
- These findings are consistent with the latest reports of NAPLEX performance which show about 30% of students are below proficiency in Domain 4 which relates to performing calculations.[1]
- Using a baseline math assessment can help students and faculty identify areas where focused review and practice are needed to build math proficiency.

Objective

Describe the mathematical abilities and deficiencies of incoming pharmacy students over a four-year period at two U.S. pharmacy schools
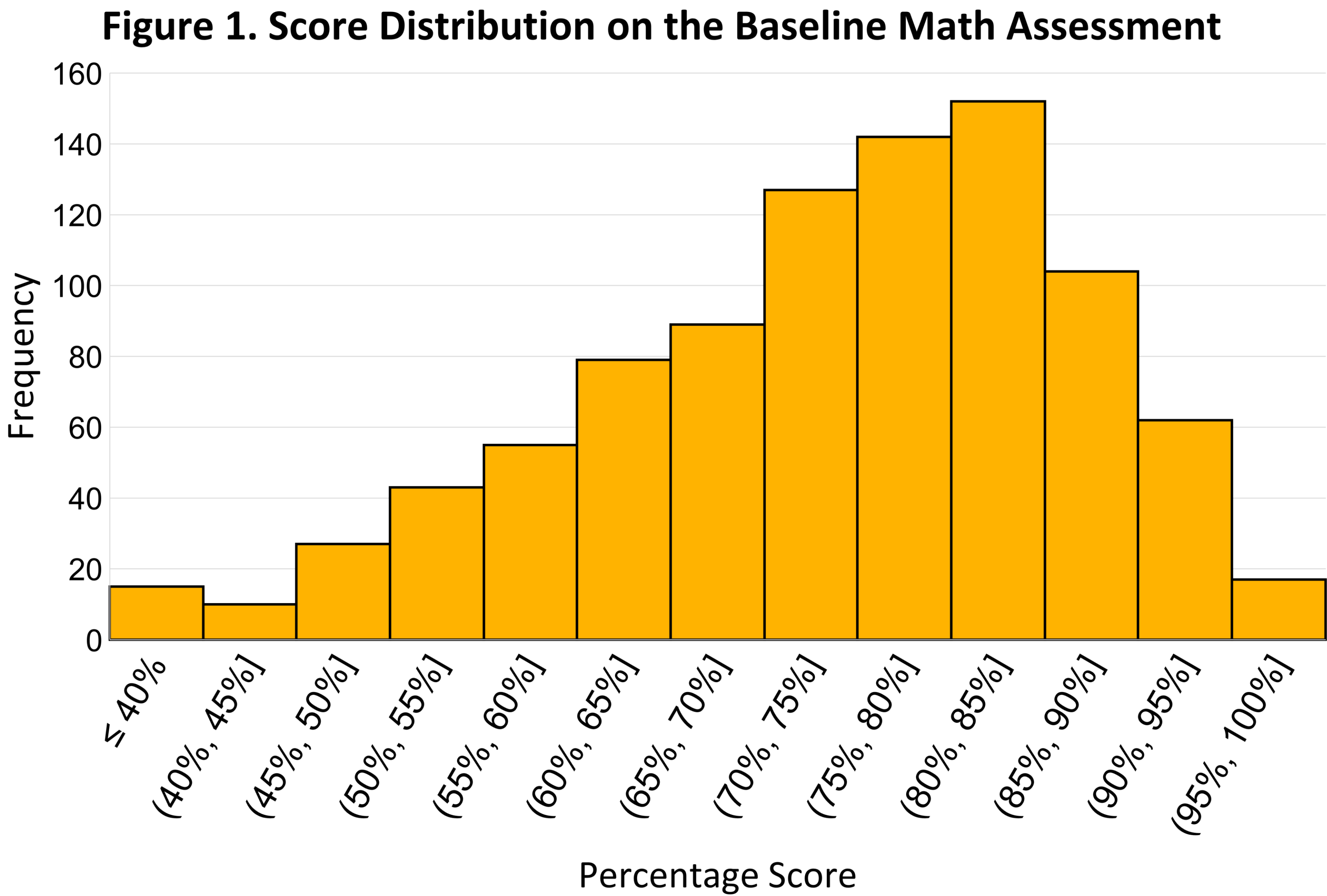
Methods

- 43 question baseline mathematics assessment created
- Tests prerequisite mathematics skills needed to learn pharmaceutical calculations: percentages and proportions, fractions and decimals, rounding, and conversions (Table 1)
- Administered at 2 public, four-year pharmacy schools between 2013-2016 during first-year pharmacy student orientation
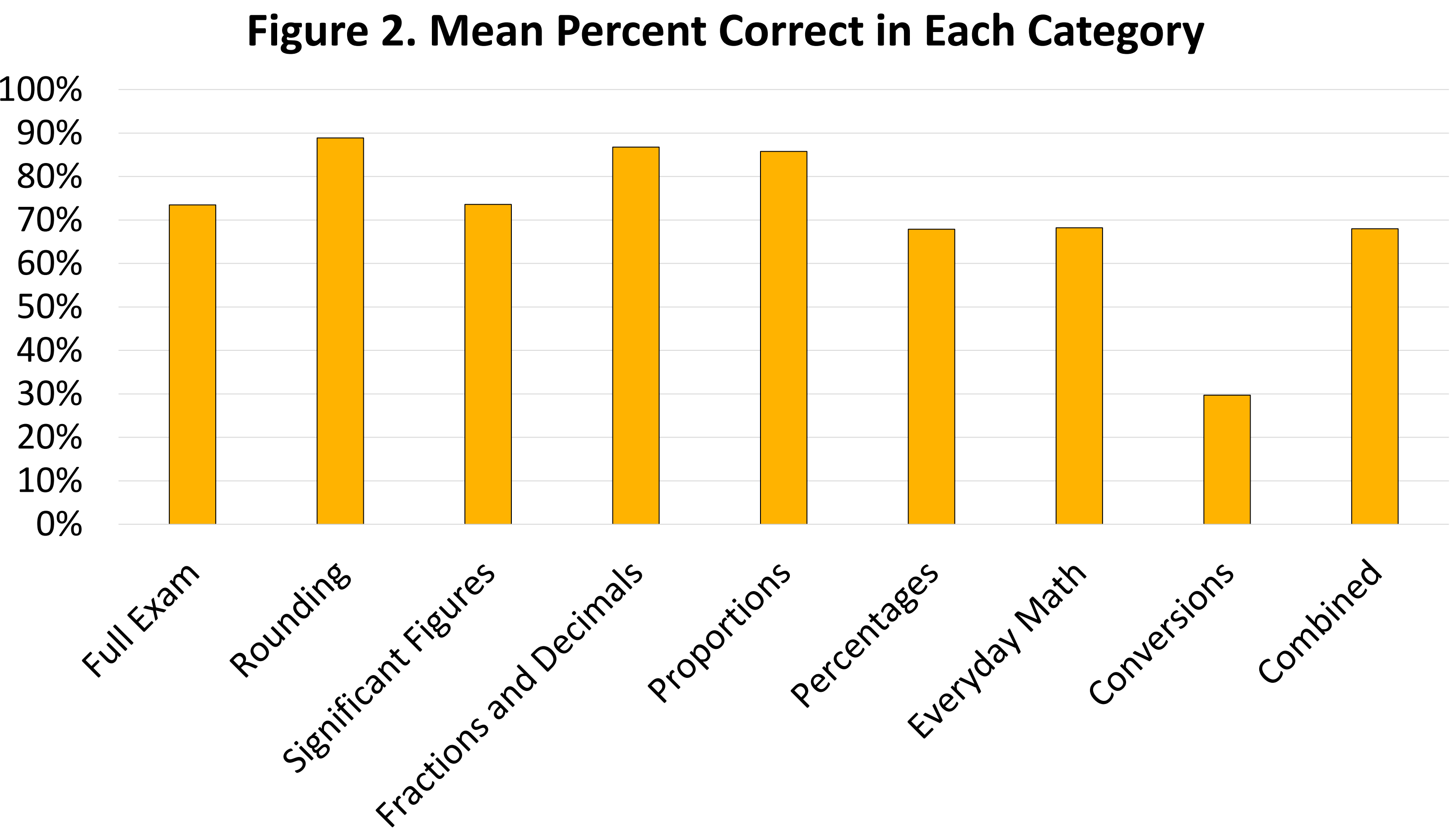
Table 1. Baseline Mathematics Assessment Categories with Sample Questions

Category	Sample Question
Rounding	Round the following numbers to the nearest tenth: 8.3456
Significant figures	How many significant figures are in the following number: 0.78290?
Fractions & Decimals	Express the following fraction as decimal: 5 ¾
Proportions	There are 200 calories in ½ cup of cake flour. How many calories are in 2 ¼ cups of cake flour?
Percentages	Calculate 0.04% of 1000 mL
Everyday Math	Rachel eats 1 serving (1 cup, 59 g) of Raisin Bran® cereal every weekday. She buys a 20 oz. (567 g) box of Raisin Bran® on Sunday (8/12). What is the last day (date) she will be able to eat a full serving of cereal?
Conversions	150 lb = _____kg
Combined	Usain Bolt ran the men's 200 meters in 19.19 seconds. What is his speed in kilometers per hour (km/h)? Round to the nearest tenth.

Results
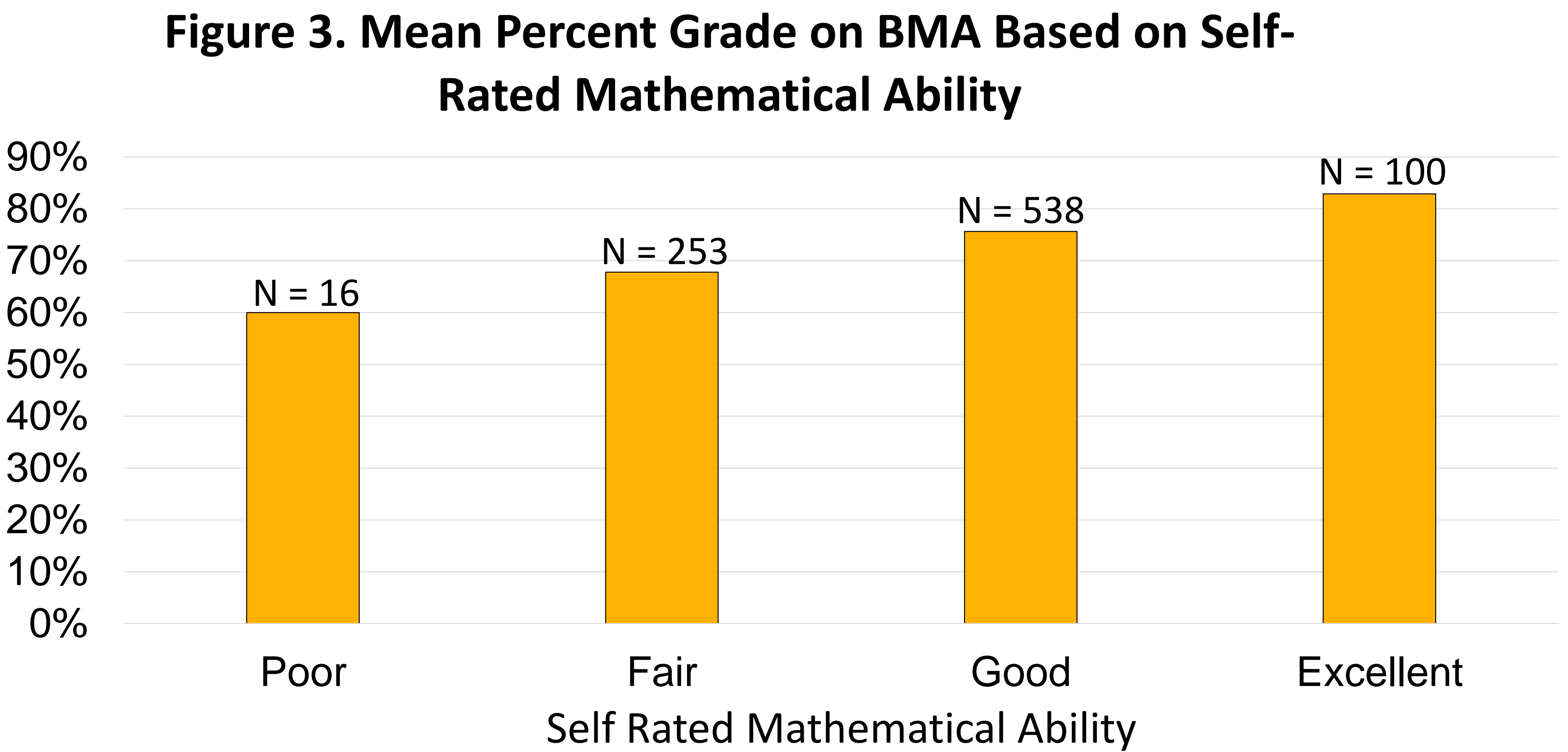
- 922 students completed BMA
- Mean score 73.8%

Figure 1. Score Distribution on the Baseline Math Assessment

Table 2. Baseline Math Assessment Performance

Question Category	# Questions (% of exam)	Cronbach's Alpha	Overall Percent Correct (SD)
Full Exam	43 (100%)	0.741	73.5% (13.2%)
Rounding	5 (11.6%)	0.585	88.9% (18.3%)
Significant Figures	4 (9.3%)	0.296	73.6% (23.3%)
Fractions and Decimals	7 (16.3%)	0.443	86.8% (14.4%)
Proportions	6 (14%)	0.405	85.8% (17.9%)
Percentages	6 (14%)	0.393	67.9% (22%)
Everyday Math	3 (7%)	0.121	68.2% (24.4%)
Conversions	5 (11.6%)	0.563	29.7% (27.4%)
Combined	7 (16.3%)	0.64	68% (26.3%)

Figure 2. Mean Percent Correct in Each Category

Results

Table 3. Combined Question Performance

Question #	Concept 1	Concept 2	Concept 3	Correct Response
10	Percent	Rounding		69.7%
16	Percent	Significant figures		71.6%
19	Percent	Proportion		86.2%
21	Percent	Proportion		63.7%
22b	Proportion	Conversions	Rounding	57.4%
23	Proportion	Rounding		50.3%
25a	Proportion	Rounding		88.4%

Figure 3. Mean Percent Grade on BMA Based on Self-Rated Mathematical Ability

Discussion

- Students matriculate into pharmacy programs with differing levels of prerequisite mathematics skills.
- Schools should ensure student support programs address the math deficiencies to promote student success.
- Based on the Cronbach's alpha analysis, subsections of the Baseline Math Assessment should not be used independently to determine math proficiency.

Limitations

- Study occurred before pandemic
- Two public pharmacy schools were included
- Students were not given forewarning of the assessment

References

1. NABP email communication. NAPLEX 2022 Calendar Year Report [individual school]. January 20, 2023.
2. National Center for Education Statistics [NCES]. NAEP Report Card: 2019 NAEP Mathematics Assessment. https://www.nationsreportcard.gov/highlights/mathematics/2019/g12/. Accessed: 2 June 2023.