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PHARMACY COLLEGE ADMISSION TEST

Test Bias, Fairness, and Standardized Admission Tests

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Abstract

In a current climate of declining applicant pools and increasing competition among schools for applicants, many programs in higher education generally and pharmacy schools in particular are considering holistic and test-optional admission policies. Relevant to this reality are questions sometimes raised regarding whether admission tests such as the PCAT contain structural elements that are biased against candidates from certain demographic groups and whether test scores unfairly penalize such candidates. These questions are addressed by reviewing the recent trend toward test-optional admission policies in higher education and in pharmacy schools, by describing the rigorous procedures used by Pearson to construct PCAT test forms that are valid and fair for all candidates, and by presenting evidence that score differences between demographic groups are not attributable to inherent unfairness in the test or in how the scores are reported.

Introduction

Many pharmacy schools have in recent years implemented test-optional admission policies, some out of a perception that the Pharmacy College Admission Test (PCAT) represents a barrier to admission for candidates at a time when schools are competing with other regional schools that do not require it. Costing candidates $210.00, the PCAT was required by 75 of the 154 pharmacy programs in the United States for 2019–20.[1] Some schools may also have concerns that PCAT scores are biased against minority and other underrepresented applicants, a view often stemming from observations of score differences between demographic groups that have consistently been found with standardized tests used for admission to professional and graduate programs in the health sciences, including the PCAT.

In this paper, we address the issue of bias by describing procedures test developers use to build validity and fairness into admission tests, using PCAT development procedures as an example. We also discuss the issue of fairness in terms of how test scores are interpreted and used. However, to adequately situate concerns about test bias and fairness, this discussion begins by considering the current movement toward test-optional admission policies in higher education generally and in pharmacy schools in particular.

Recent Test-Optional Admission Trends in Higher Education

Even though the most common factors colleges base decisions on for first-time freshmen continue to be high school grades, the strength of a high school curriculum, and admission test scores, recent studies conducted by the National Association for College Admission Counseling suggest the number of colleges observing a test-optional admission policy "has dramatically expanded in recent years,"[2] with 18% of colleges considering a test-optional admission policy to be of "considerable importance."[3] In fact, according to The National Center for Fair and Open Testing, as of the winter of 2019 over 1,000 accredited American colleges and universities observe either a test-optional or test-flexible admission policy, both of which de-emphasize the use of standardized tests in admission decisions, with over 220 schools adopting such policies since 2005.[4]

This trend is not limited to undergraduate admission but is increasingly being considered by graduate and professional schools as well, primarily out of concerns related to equity and predictive utility.[5] A recent study conducted by the Council of Graduate Schools (CGS) describes the emerging practice of moving toward holistic methods of evaluating candidates for admission as de-emphasizing quantitative measures, such as standardized test scores and previous grade point averages (GPAs), and placing greater emphasis on qualitative "noncognitive and personal attributes."[6] Only 35% of master's degree programs responding to a CGS survey indicated they are currently requiring a standardized test score other than a test of English language proficiency, admittedly doing so to maintain national rankings or to meet accreditation requirements.[7]

A drop in the overall pharmacy school applicant pool in recent years has led many pharmacy schools to also reconsider their admission policies, reflecting the same trend toward test-optional admission policies as seen with undergraduate and graduate schools. Comparisons between pharmacy school admission policy data from 2013–14 and 2019–20 reveal that 28% fewer pharmacy schools require the PCAT.[1,8] This trend is evident as some pharmacy programs move toward admission practices that include nondidactic measures such as the multi-mini interview and considering candidates' demographic characteristics such as their socioeconomic status to assess noncognitive characteristics.[9,10, 11]

Some study findings suggest that one factor involved in this decrease in applications could relate to financial burdens faced by pharmacy school graduates relative to those faced by graduates considering other health professions. A study by Cain et al reported that debt among pharmacy students rose by 23% between 2008 and 2012, whereas the increases in debt for medical and dental students during the same period were 4.7% and 8.5%, respectively, with the potential return on investment for attending pharmacy school decreasing more than for attending either medical or dental school.[12] A Pharmacy Graduating Student Survey conducted in 2018 by the American Association of Colleges of Pharmacy (AACP) revealed that nearly 85% of graduates indicated that they took out loans to pay for their PharmD education, with an average loan amount of $166,528.[13]

Evidence suggests that another factor affecting the number of students considering pharmacy school may relate to changing market conditions. The demand for pharmacists was moderate in 2008, but the demand has leveled off since then, with difficulties filling certain open positions and an overall decline in available jobs in the field.[14] According to the December 2018 Pharmacist Demand Indicator (PDI) survey, respondents representing different organizations that employ pharmacists mostly agreed that the supply and demand for generalist/staff pharmacists was "balanced."[15] Even though a balanced supply and demand may be desirable, a continued increase in the number of pharmacy schools may saturate the market with graduates, and leave prospective applicants with the perception of fewer job prospects and mounting debt.[16]

Legitimate concerns related to market conditions and perceived barriers for pharmacy school applicants, particularly for underrepresented minority candidates,[17] suggest the complexity of the situation now facing schools of pharmacy. The degree to which questions related to the validity of PCAT scores for all candidates may factor into these concerns suggests a clear understanding of what is involved in questions of test bias and fairness can only help inform admission policy decisions.

Test Item Development and the Question of Bias

A concern among some pharmacy schools is that observed differences in PCAT scores between demographic groups suggest the test is biased against certain groups—particularly female, African American, and Hispanic individuals.[18] However, high-stakes admission tests are developed with rigorous procedures to assure that test bias does not occur, and are administered, scored, and reported following the same procedures for all candidates.

PCAT test forms consist of both operational items (used in scoring) and experimental items being field-tested for possible future operational use. All PCAT items are developed to match a test content blueprint approved by the AACP PCAT Advisory Committee.

PCAT items are written by outside experts who have at least a master's degree in the relevant content area, and are then reviewed by others with similar expertise. As a precondition for a valid and fair assessment, guidelines for writers and reviewers require all content in passages, graphics, and questions is free of stereotyping, bias, and insensitivity related to age, sex, ethnicity, religious creed, economic status, geographic location, and physical or psychological impairments or conditions. Pearson content experts then review each item for content appropriateness, style and format consistency, and freedom from bias or insensitivity. Items that pass this review are eligible to be field-tested as experimental items on PCAT test forms.

After experimental items have been field-tested, psychometric analyses are performed using item response theory (IRT) and classical test theory to determine three characteristics of each item: difficulty, “fit,” and differential item functioning (DIF). The IRT method of determining item difficulty assumes the probability of a candidate responding correctly to a test item is a function of both the difficulty of the item and the ability of the individual, with item difficulty defined as its location on a difficulty scale (ie, items of higher values are considered more difficult) and individual ability defined as the probability of responding correctly to the item (ie, a latent trait determined through the Rasch method). To contribute to the effectiveness of the test, an item should be neither extremely easy nor extremely difficult.

The fit of an item is a measure of the agreement between the actual performance of examinees of different ability levels and the expected performance if the item is a good measure of the ability assessed. High-ability examinees should answer correctly more often than low-ability examinees. Otherwise, the item does not provide information about the examinee’s ability level and is thus invalid. One type of fit statistic reflects how the probability of answering correctly increases as examinee ability increases. A second type of fit indicator is the point-biserial correlation between examinees’ item performance and their ability scores, which reflects the difference in average ability between those who answer the item correctly and those who do not. Items can have poor fit because of either poor content validity, whereby the question is not strongly related to the subtest domain, or due to unclear presentation, which causes misinterpretation that can result in a weak correct option or a defensible incorrect option. Regardless of the reason, PCAT experimental items with poor fit are rejected as not validly differentiating between candidates of different ability levels and, as a result, not contributing to validity.

A third type of item analysis, differential item functioning (DIF, using the Mantel-Haenszel procedure), specifically relates to score differences between demographic groups and focuses on the fairness of items by evaluating whether an item is equally difficult for all candidates of the same ability level, regardless of their demographic group.[19] The DIF analyses conducted for PCAT items compare two candidate demographic groups at a time: female with male, White with non-White, and parent education levels (candidates with at least one parent/guardian having earned a bachelor’s degree or higher compared to candidates with no parent/guardian having earned at least a bachelor’s degree). Any PCAT item that is more difficult for members of one group than for equally able members of the other group is rejected, regardless of whether the item content appears to be free of bias.

Even though the statistical item-analysis procedures described above are necessary to minimize the possibility of item bias and assure test validity and fairness, the National Center for Fair & Open Testing (FairTest) considers item fit to be a flawed criterion that tends to eliminate items frequently answered correctly by members of underrepresented groups (due to their lower average total scores).[20] However, as pointed out earlier, good fit is necessary for an item to be a valid measure of the relevant ability. As well-intentioned as the FairTest concern may be, items that are equally likely to be answered correctly by high- and low-ability individuals provide no information about a candidate’s ability but instead reduce the validity and increase the measurement error of scores for candidates from all demographic groups.

Only items that meet all the criteria described above are used by PCAT test development and psychometric professionals to construct test forms following strict content, formatting, and item difficulty range criteria. Final PCAT forms are computer-administered under standard, carefully controlled conditions at Pearson VUE Test Centers (computer-based-testing centers located across the United States and around the world), with strict security precautions taken to verify candidate identity and ensure each administration is valid. Immediately after testing, psychometric reviews are conducted to verify the accuracy of all score data before scores are reported to candidates and to individual schools.

Test Score Differences and the Question of Fairness

Although test developers use rigorous procedures and analyses to avoid item bias and maximize test form validity, the question remains whether scores from an admission test such as the PCAT are fair and valid for use with all candidates. The 2014 *Standards for Educational and Psychological Testing* characterizes fairness as a basic validity consideration that "requires attention throughout all stages of test development and use,"[21] and the National Council on Measurement in Education defines *fairness* as the "[t]he validity of test score interpretations for intended use(s) for individuals from all relevant subgroups."[22]

It will be useful in addressing the issue of fairness to include a review of recent annual PCAT score differences for candidates from different demographic groups and to compare these differences with similar differences for other standardized admission tests commonly used in the health sciences. Comparisons of recent one-year PCAT score data[23] with score data drawn from reports by the publishers of the *Dental Admission Test* (DAT),[24] the *Graduate Record Examinations* (GRE),[25] the *Medical College Admission Test* (MCAT),[26,27] the *Optometry Admission Test* (OAT)[28] illustrate the score differences often observed between females and males (Table 1) and between selected race/ethnicity groups (Table 2). To facilitate comparisons across tests, Tables 1 and 2 also include effect sizes that indicate the magnitude of score differences in standard-deviation units between demographic groups for each subtest of each test shown.[29]

Table 1 Means and Standard Deviations (*SD*) of Scaled Scores and Writing Scores for Five Post-Secondary Admission Tests by Voluntary Self-Reported Candidate Sex, and Effect Sizes for Score Differences Between Female and Male Candidate Groups

		Female		Male		
Admission test / subtest		**Mean**	***SD***	**Mean**	***SD***	**Effect size**
DAT	*n*	6,890		5,503		
Biology		18.2	3.0	19.1	3.1	0.3
General Chemistry		18.3	3.4	19.4	3.5	0.3
Organic Chemistry		18.3	3.9	19.5	4.0	0.3
Perceptual Ability		18.6	2.5	19.5	2.6	0.4
Quantitative Reasoning		17.5	3.3	18.7	3.4	0.4
Reading Comprehension		20.1	2.9	20.3	2.9	0.1
Survey of the Natural Sciences		18.2	2.9	19.2	3.0	0.3
Academic Average		18.5	2.7	19.4	2.7	0.3
GRE	*n*	199,698		113,925		
Verbal Reasoning		151.6	7.6	154.4	7.8	0.4
Quantitative Reasoning		148.6	7.3	153.1	8.3	0.6
Analytical Writing		3.9	0.8	3.9	0.8	0.0
MCAT	*n*	26,882		25,875		
CPBS		125.7	2.7	127.0	2.6	0.5
CARS		125.7	2.8	126.0	2.7	0.1
BBLS		126.1	2.7	127.1	2.6	0.4
PSBB		126.7	2.8	127.0	2.6	0.1
Total Score		504.1	9.5	507.2	8.8	0.3
OAT	*n*	2,367		1,006		
Biology		303.5	44.4	312.3	47.4	0.2
General Chemistry		305.6	44.1	318.1	46.8	0.3
Organic Chemistry		299.3	44.7	306.0	47.8	0.2
Physics		279.7	39.8	295.7	43.4	0.4
Reading Comprehension		323.5	37.3	325.4	38.9	0.1
Quantitative Reasoning		308.8	39.5	321.6	41.9	0.3
Total Science		295.0	42.4	307.9	46.1	0.3
Academic Average		304.2	33.2	314.0	35.7	0.3
PCAT	*n*	9,620		4,966		
Biological Processes		407.0	21.5	410.9	22.0	0.2
Chemical Processes		407.1	23.9	412.1	24.5	0.2
Critical Reading		391.1	22.2	393.9	23.0	0.1
Quantitative Reasoning		400.1	19.0	404.5	20.1	0.2
Composite		401.4	17.6	405.5	18.2	0.2
Writing		2.78	0.72	2.82	0.75	0.1

CPBS = Chemical and Physical Foundations of Biological Systems.

CARS = Critical Analysis and Reasoning Skills.

BBLS = Biological and Biochemical Foundations of Living Systems.

PSBB = Psychological, Social, and Biological Foundations of Behavior.

Table 2 Means and Standard Deviations (*SD*) of Scaled Scores and Writing Scores for Five Post-Secondary Admission Tests by Selected Voluntary Self-Reported Race/Ethnicity, and Effect Sizes for Score Differences Between Black / African American and White (B/W) and Between Hispanic / Latino and White (H/W) Candidate Groups

		Black / African American		**Hispanic / Latino**		**White**		**Effect size**	
Admission test / subtest		**Mean**	***SD***	**Mean**	***SD***	**Mean**	***SD***	**B/W**	**H/W**
DAT	*n*	896		315		6,135			
Biology		16.8	2.9	17.7	3.1	18.6	2.9	0.6	0.3
General Chemistry		16.5	3.2	17.4	3.6	18.7	3.3	0.7	0.4
Organic Chemistry		16.4	3.6	17.2	4.0	18.9	3.8	0.7	0.4
Perceptual Ability		16.9	2.5	18.1	2.5	19.2	2.5	0.9	0.4
Quantitative Reasoning		15.6	2.7	16.1	2.8	18.1	3.1	0.8	0.6
Reading Comprehension		18.8	2.8	18.9	2.6	20.5	2.9	0.6	0.5
Survey of the Natural Science		16.5	2.8	17.4	3.0	18.6	2.8	0.7	0.4
Academic Average		16.8	2.4	17.5	2.6	19	2.5	0.9	0.6
GRE	*n*	26,665		30,539		186,623			
Verbal Reasoning		146.9	7.6	149.6	7.5	153.7	7.2	0.9	0.6
Quantitative Reasoning		143.9	7.0	147.1	7.5	150.9	7.4	1.0	0.5
Analytical Writing		3.3	0.8	3.6	0.8	4.0	0.8	0.9	0.5
MCAT	*n*	4,430		3,297		24,686			
CPBS		124.1	2.7	124.9	2.7	126.5	2.5	1.0	0.6
CARS		123.8	2.6	124.3	2.7	126.4	2.5	1.0	0.8
BBLS		124.4	2.7	125.3	2.7	126.9	2.5	1.0	0.6
PSBB		124.8	2.8	125.4	2.9	127.2	2.5	0.9	0.7
Total Score		497.1	9.1	499.9	9.4	507.1	8.2	1.2	0.9
OAT	*n*	146		332		1,908			
Biology		282.3	41.7	293.0	43.7	304.3	44.2	0.5	0.3
General Chemistry		280.7	41.4	295.8	45.0	306.4	44.1	0.6	0.2
Organic Chemistry		278.0	41.6	288.6	42.1	298.0	44.4	0.5	0.2
Physics		257.2	33.2	269.0	37.2	282.0	39.9	0.6	0.3
Reading Comprehension		298.4	35.7	312.4	36.7	326.8	37.5	0.8	0.4
Quantitative Reasoning		280.1	37.3	292.4	39.9	310.9	38.8	0.8	0.5
Total Science		268.8	37.7	282.8	40.8	295.8	42.0	0.7	0.3
Academic Average		280.1	29.9	292.5	31.6	305.5	32.7	0.8	0.4
PCAT	*n*	1,755		2,037		7,596			
Biological Processes		398.7	19.8	403.2	20.3	408.6	20.8	0.5	0.3
Chemical Processes		397.8	21.4	403.1	22.6	408.4	22.9	0.5	0.2
Critical Reading		381.3	20.8	385.2	20.8	395.9	22.2	0.7	0.5
Quantitative Reasoning		390.9	16.2	393.0	17.4	401.8	17.9	0.6	0.5
Composite		392.3	15.4	396.3	16.2	403.8	16.9	0.7	0.4
Writing		2.52	0.69	2.57	0.70	2.88	0.73	0.5	0.4

B/W = Effect sizes for differences between mean scores of Black / African American and White candidate groups.

H/W = Effect sizes for differences between mean scores of Hispanic / Latino and White candidate groups.

The score data in Tables 1 and 2 show male candidates scoring somewhat higher than female candidates and White candidates averaging higher scores than both Black/African American and Hispanic/Latino candidates for each of the five admission tests. Effect sizes for the test subtests shown in Table 1 suggest score differences between female and male candidates that are mostly small (0.2–0.4), with a few that are negligible (0.0–0.1) and a few that are medium (0.5–0.7). For score differences between Black/African American and White and between Hispanic/Latino and White candidates, Table 2 shows larger effect sizes, with most either small (0.2–0.4) or medium (0.5–0.7) but with several that are large (≥0.8).

Even though these data show consistent patterns in the direction and size of differences on similar types of subtests for the PCAT and for the other four admission tests, the question is whether these differences are due to test bias that unfairly affects certain groups. High-stakes admission tests like the PCAT are developed with rigorous procedures to assure test bias does not occur, and are administered, scored, and reported following the same procedures for all candidates. Recent pharmacy school applicant pool data show acceptance rate differences by demographic category (Table 3) similar to the scores differences by demographic group shown in Tables 1 and 2.

Table 3 PharmCAS Applicants and Applicants Accepted by a Pharmacy School for 2018–19 by Voluntary Self-Reported Sex and Race/Ethnicity

	Applicants		Accepted		
Demographic group	***n***	**%**	***n***	**%**	**Rate**
Sex	15,313	100.0%	12,691	100.0%	
Female	9,902	64.7%	8,218	64.8%	83.0%
Male	5,411	35.3%	4,473	35.2%	82.7%
Race/ethnicity	15,019	100.0%	12,455	100.0%	
American Indian / Alaska Native	31	0.2%	23	0.2%	74.2%
Asian	3,847	25.6%	3,213	25.8%	83.5%
Black / African American	1,938	12.9%	1,382	11.1%	71.3%
Native Hawaiian / Pacific Islander	23	0.2%	17	0.1%	73.9%
White	7,003	46.6%	6,089	48.9%	86.9%
Multiple (race/ethnicity)	434	2.9%	356	2.9%	82.0%
Hispanic / Latino	1,743	11.6%	1,375	11.0%	78.9%

Demographic group = Each applicant is represented in only one race/ethnicity category.

Applicants = Individuals submitting a PharmCAS application.

Accepted = Applicants accepted by a pharmacy school (whether or not matriculated).

% = Percent within each demographic category (ie, Sex, Race/ethnicity).

Rate = Percent of applicants accepted by a pharmacy school for each demographic group.

Table 3 includes aggregate data from 133 programs participating in the Pharmacy College Application Service (PharmCAS) during the 2018–19 admission cycle showing nearly identical acceptance rates for female and male applicants (83.0% and 82.7%, respectively), but showing higher acceptance rates for White applicants (86.9%) than for Black/African American (71.3%) and Hispanic/Latino applicants (78.9%).[30] These acceptance rate differences highlight the relevance of the fairness issue with regard to considerations of candidates from underrepresented minority groups in the admission process generally and related to the PCAT and other standardized tests specifically.

A 2016 article in *The Atlantic* addresses the issue of fairness by discussing perceived "limitations of standardized admission tests like the GRE . . . and the obstacles they can pose to otherwise talented students, many of whom are disadvantaged minorities."[31] Even though the GRE focuses on verbal and math skills rather than the content knowledge assessed by more specialized tests such as PCAT, the critiques expressed in the article are broadly relevant, especially regarding suggestions that observed score differences between demographic groups could be due to flaws in admission tests.

One suggestion made by some critics is that the tests intentionally or inadvertently measure the wrong things. For example, the cognitive psychologist Robert Sternberg claims in *The Atlantic* article "[t]he GRE is a proxy for asking 'Are you rich?' 'Are you white?' 'Are you male?'"[31] Sternberg also asserts score differences between demographic groups are due to "memory and analytical skills" measured by admission tests, which are "precisely the abilities in which many students of the middle and upper middle class excel."[32]

An obvious response to this challenge is that the constructs measured by admission tests, often chosen by a board representing the profession (eg, the AACP PCAT Advisory Committee), are believed to be effective in predicting success in professional education. Some components of admission tests (such as the PCAT's Biological Processes and Chemical Processes subtests) measure developed knowledge and skills that are preconditions for more advanced study, but even components measuring abilities in reading, writing, and math have rational and empirically demonstrated relationships to academic success. While schools adopting test-optional admission policies may use methods other than test scores to identify relevant skills or abilities, the crucial questions are whether alternatives to standardized test scores are as feasible to obtain, are as effective at predicting success, and result in smaller group performance differences.

Another perceived flaw, related to test content, is that admission tests underestimate the potential of students who have not had the opportunity to develop the skills relevant to success in higher education, particularly among underrepresented minorities. Professor of pediatrics and diversity vice-chancellor Billy R. Thomas has observed that "[m]any minority students attend schools that are under resourced, have high student-to-teacher ratios, have no AP courses, and are lacking in tutoring and counseling services."[33] A study by the Association of American Medical Colleges (AAMC) documented these differences in detail for candidates taking the MCAT, concluding that observed score differences are not due to test bias but may rather be explained by such factors as "family, neighborhood, and school conditions, which relate to academic achievement and differ by group."[34] Measuring potential at the post-secondary level is indeed challenging, especially considering Sternberg's suggestion that it is unfair to measure abilities such as memory and analytical thinking because they are related to socioeconomic status.[32]

The critiques reviewed thus far suggest that candidates' true ability to succeed in a professional program tends to be underestimated by scores on admission tests. However, in a summary of meta-analyses conducted for several standardized tests commonly used for admission to graduate or professional programs—including the GRE, MCAT, and PCAT—Kuncel and Hezlett found no differential prediction by sex, and for predictions differing by race or ethnicity found "tests systematically favor minority groups," meaning their test scores predicted higher outcomes than students actually obtained.[35] These researchers note that observations of test scores underpredicting the performance of women in undergraduate but not graduate school "can be attributed to differences between men and women . . . in terms of their responsibility and study behaviors as well as the influence of genders differentially enrolling in majors and courses that vary in their grading severity."[35] They conclude that "once these other factors are considered the relationship between test scores and subsequent performance becomes nearly identical for the two genders" and that "the tendencies for groups to differentially enroll in courses across disciplines" can influence "under prediction of grades for women and minorities."[36]

A 2009–10 validation study conducted by Pearson at 22 pharmacy colleges, the AAMC study mentioned earlier, and a recent University of California (UC) systemwide Academic Senate Standardized Testing Task Force study obtained results supporting Kuncel's and Hezlett's conclusion that standardized test scores do not underestimate the subsequent performance of candidates from minority groups. Even though issues of sample representation and recency may qualify the Pearson study results, PCAT scores were found to be equally strong predictors of first-year GPA, regardless of candidates' sex, race, or ethnicity, and strong predictors of GPA for candidates with lower parent education.[37] The AACM study determined MCAT scores do not underpredict graduation rates for either African American or Latino medical students.[34] And the UC study found disparities in standardized test scores to reflect unequal access to quality K-12 preparation rather than test bias and, compared to undergraduate GPAs, found ACT and SAT scores to be "better predictors of success for students who are Underrepresented Minority students (URMs), who are first-generation, or whose families are low-income" in terms of both undergraduate GPAs and completion rates.[38]

A third perceived shortcoming of admission tests, in addition to measuring the wrong things or failing to measure potential, relates to bias in the way test scores are reported for underrepresented minorities. To represent concerns regarding differential performances on admission tests, *The Atlantic* article quotes professor of higher education Julie R. Posselt who suggests using subgroup-specific norms to accommodate for demographic differences in reported scores by providing "the percentile ranking based on the test-taker's national origin, field of study, and maybe parent education, race, and gender."[31]

Such demographically based test norms are sometimes used in diagnostic settings when controlling for background variables can help identify a clinical condition. Separate racial/ethnic percentile conversions were also used by the US Employment Services in an attempt to compensate for differences in scores earned by individuals from different demographic groups on an application test for government jobs, until determining that this practice violated 1991 amendments to Title VII of the Civil Rights Act of 1964.[39] Title VII clearly states that it is unlawful "to adjust the scores of, use different cutoff scores for, or otherwise alter the results of, employment related tests on the basis of race, color, religion, sex, or national origin."[40] For admission testing, using subgroup-specific norms would weaken predictions of professional-school success by weakening ties to an applicant's actual ability, thereby jeopardizing fairness at the individual level.

Conclusion

The current trend toward test-optional admission policies in higher education and in pharmacy schools makes a consideration of test bias and fairness especially relevant. Evidence of declining birthrates in the United States and declining numbers of high school graduates portend nationwide college applicant declines.[41] Confronted with this reality, some pharmacy schools may consider suspending standardized testing requirements, as the UC Board of Regents decided to do[42] despite the empirically-based recommendation of their own UC Faculty Senate report not to implement a test optional admission policy.[38]

Pharmacy schools questioning the practicality of the PCAT should consider the rigorous editorial and psychometric development procedures designed to ensure that each test item is free of insensitive content and a valid measure for all demographic groups, and the consistent evidence showing equitably administered test forms produce reliable and fair scores that continue to show predictive value for all candidates. These assurances suggest that standardized admission tests such as the PCAT are not biased and that scores from these tests are valid and fair indicators of candidate ability.

References

1. American Association of Colleges of Pharmacy. Admission policies. https://www.aacp.org/sites/default/files/2019-12/psar-19-20-table-6.pdf. Accessed April 3, 2020.
2. Syverson ST, Franks VW, Hiss WC. *Defining Access: How Test-Optional Works*. Arlington, VA: National Association for College Admission Counseling; 2018. https://www.nacacnet.org/globalassets/documents/publications/research/defining-access-report-2018.pdf. Accessed February 21. 2019.
3. Clinedinst M., Patel P. *2018 State of College Admissions*. Arlington, VA: National Association for College Admission Counseling. https://www.nacacnet.org/globalassets/documents/publications/research/2018_soca/soca18.pdf. Accessed, February 19, 2019.
4. The National Center for Fair and Open Testing. More than 1000 accredited colleges and universities that do not use ACT/SAT scores to admit substantial numbers of students into bachelor-degree programs. https://www.FairTest.org/university/optional. Accessed February 21, 2019.
5. Posselt JR, Miller CW. Doctoral programs need to rethink their use of standardized tests. *Inside Higher Ed*. May 7, 2018. https://www.insidehighered.com/print/admissions/views/2018/05/07/doctoral-programs-need-rethink-their-use-standardized-tests-opinion. Accessed February 19, 2019.
6. Kent JD, McCarthy MT. *Holistic Review in Graduate Admissions: A Report from the Council of Graduate Schools*. Washington, DC: Council of Graduate Schools; 2016. https://cgsnet.org/ckfinder/userfiles/files/CGS_HolisticReview_final_web.pdf. Accessed February 19, 2019.
7. Okahana H, Augustine RM, Zhou E. *Master's Admissions: Transparency, Guidance, and Training*. Washington, DC: Council of Graduate Schools; 2018. https://cgsnet.org/ckfinder/userfiles/files/CGS_HolisticReview_final_web.pdf. Accessed February 19, 2019.
8. American Association of Colleges of Pharmacy. *Pharmacy School Admission Requirements 2013–14*. Alexandria, VA: American Association of Colleges of Pharmacy; 2013. Table 9, pages 268–271.

9. Nohria R, Adams J, Garrison GE. (2018). Inclusion of socioeconomic status (SES) as an additional criterion in holistic pharmacy school admission processes [published online ahead of print (July 20, 2018)]. *Am J Pharm Educ.* https://www.ajpe.org/doi/pdf/10.5688/ajpe7016. Accessed February 21, 2019.

10. Wall AL, Aljets A, Ellis SC, Hansen DJ, Moore WM, Petrelli HMW, Speedie MK, TenHoeve T, Watchmaker C, Winnike JS, and Wurth SD. White paper on pharmacy admissions: developing a diverse work force to meet the health-care needs of an increasingly diverse society. *Am Journal Pharm Educ.* 2015;79(7):Article S7.

11. Wilcox RE, Lawson KA. Predicting performance in health professions education programs from admissions information—comparisons of other health professions with pharmacy. *Curr Pharm Teach Learn.* 2018;10: 529–541.

12. Cain J, Campbell T, Congdon HB, Hancock K, Kaun M, Lockman PR, Evans RL. Pharmacy student debt and return on investment of a pharmacy education. *Am J Pharm Educ.* 2014;78(1):Article 5.

13. American Association of Colleges of Pharmacy. American Association of Colleges of Pharmacy graduating student survey 2018 national summary report. https://www.aacp.org/sites/default/files/2018-08/2018%20GSS%20National%20Summary%20Report.pdf. Accessed March 3, 2019.

14. Brown DL. A looming jobless crisis for new pharmacy graduates and the implications it holds for the academy. *Am J Pharm Educ.* 2013;77(5):Article 90.

15. Pharmacy Workforce Center (2019). Pharmacist Demand Indicator (PDI) summary report, fourth quarter (December) 2018. Madison, WI: Pharmacy Workforce Center. https://pharmacymanpower.com/archive/SummaryReport2018Q4.pdf. Accessed February 26, 2019.

16. Lebovitz L, Eddington D. Trends in the pharmacist workforce and pharmacy education. *Am J Pharm Educ.* 2019;83(1):Article 7051.

17. Alonzo N, Bains A, Rhee G, Htwe K, Russell J, De Vore D, Chen XL, Nguyen M, Rajagopalan V, Schulte S, Doroudgar S. Trends in and barriers to enrollment of underrepresented minority students in a pharmacy school. *Am J Pharm Educ.* 2019;83(7): Article 6925.

18. Warne RT, Yoon M, Price CJ. Exploring the various interpretations of "test bias." *Cultural Diversity and Ethnic Minority Psychology.* 2014;20(4): 570–482.

19. Holland PW, Thayer DT. Differential item performance and the Mantel-Haenszel procedures. In Wainer H, Braun HI, eds. *Test Validity.* Hillsdale, NJ: Lawrence Erlbaum; 1988:129–145.

20. National Center for Fair & Open Testing. Racial bias built into tests. https://www.fairtest.org/racial-bias-built-tests. Accessed July 22, 2019.

21. American Educational Research Association, American Psychological Association, National Council on Measurement in Education, Joint Committee on Standards for Educational and Psychological Testing (U.S.). *Standards for Educational and Psychological Testing*. Washington, DC: AERA; 2014: 49.

22. National Council on Measurement in Education. Assessment glossary. https://www.ncme.org/resources/glossary. Accessed January 2, 2020.

23. Meagher DG, Wegner R, Ybarra N. Annual PCAT Score Data for 2018–19. Document presented at: 2019 AACP Annual Meeting, PCAT Advisory Committee Meeting;17; Chicago, IL.

24. American Dental Association. *Dental Admission Test (DAT) User's Manual 2017*. 2019. https://www.ada.org/~/media/ADA/Education%20and%20Careers/Files/dat_users_manual.ashx. Accessed March 13, 2019.

25. Educational Testing Service. *A Snapshot of the Individuals Who Took the GRE General Test July 2013–June 2018*. 2019. https://www.ets.org/s/gre/pdf/snapshot_test_taker_data_2018.pdf. Accessed June 14, 2019.

26. Association of American Medical Colleges. Table A-21: MCAT scores and GPAs for applicants to U.S. medical schools by sex, 2018-2019. https://www.aamc.org/download/321504/data/factstablea21.pdf. Accessed June 14, 2019.

27. Association of American Medical Colleges. Table A-18: MCAT scores and GPAs for applicants and matriculants to U.S. medical schools by race/ethnicity, 2018-2019.. https://www.aamc.org/download/321498/data/factstablea18.pdf. Accessed June 14, 2019.

28. Association of Schools and Colleges of Optometry. *OAT User Guide 2017 Data*. 2019. https://www.ada.org/~/media/OAT/Files/oat_user_guide.pdf?la=en. Accessed June 14, 2019.

29. Cohen J. *Statistical Power Analysis for the Behavioral Sciences* (2nd ed). Hillsdale, NJ: Lawrence Erlbaum; 1988.

30. American Association of Colleges of Pharmacy. *2018–2019 PharmCAS Applicant Data Report*. https://connect.aacp.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=6fd0bf77-20d6-8bd0-ea8f-802291427396. Accessed January 7, 2020.

31. Clayton V. The problem with the GRE. *The Atlantic*. March 1, 2016. https://www.theatlantic.com/education/archive/2016/03/the-problem-with-the-gre/471633/. Accessed July 24, 2019.

32. Sternberg R, Bonney CR, Gabora L, Merrifield M. WICS: A model for college and university admissions. *Educational Psychologist*. 2012;47(1): 30–41.

33. Thomas, BR. Standardized tests favor students from high-income families. *The Chronicle of Higher Education*. June 27, 2018. https://www.chronicle.com/blogs/letters/standardized-tests-favor-students-from-high-income-families/. Accessed July 24, 2019

34. Davis D, Dorsey JK, Franks RD, Sackett PR, Searcy CA, Zhao X. Do racial and ethnic group differences in performance on the MCAT exam reflect test bias? *Academic Medicine*. 2013;88(5): 593–602.

35. Kuncel NR, Hezlett SA. Standardized tests predict graduate students' success. *Science*. 2007;315: 1080–1081.

36. Kuncel NR, Hezlett SA. Supporting online material for standardized tests predict graduate students' success. *Science*. 2007. www.sciencemag.org/cgi/content/full/315/5815/1080/DC1. Accessed December 31, 2019.

37. Meagher DM, Pan T, Perez CD. Predicting performance in the first-year of pharmacy school. *Am J Pharm Educ*. 2011;75(5): Article 81.

38. University of California Academic Senate. *Report of the UC Academic Council Standardized Testing Task Force (STTF)*. January 2020. https://senate.universityofcalifornia.edu/_files/underreview/sttf-report.pdf. Accessed April 9, 2020.

39. Gottfredson LS. The science and politics of race-norming. *American Psychologist*. 1994;49(11): 955–963.

40. *U.S. Equal Employment Opportunity Commission*. Title VII of the Civil Rights Act of 1964. https://www1.eeoc.gov//laws/statutes/titlevii.cfm?renderforprint=1. Accessed January 2, 2020.

41. Kline M. The looming higher ed enrollment cliff. *Higher Ed HR Magazine*. Fall 2019. https://www.cupahr.org/issue/feature/higher-ed-enrollment-cliff/. Accessed January 7, 2020.

42. UC Office of the President. University of California Board of Regents unanimously approved changes to standardized testing requirement for undergraduates. May 21, 2020. Accessed July 1, 2020. https://www.universityofcalifornia.edu/press-room/university-california-board-regents-approves-changes-standardized-testing-requirement