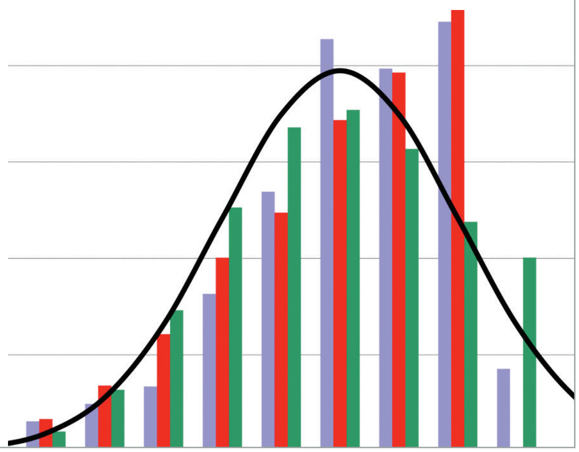
July 2013

ACT Research Report Series

2013 (4)



Differential Effects of Using ACT® College Readiness Assessment Scores and High School GPA to Predict First-Year College GPA among Racial/Ethnic, Gender, and Income Groups

Edgar I. Sanchez

For additional copies:
ACT Research Report Series
P.O. Box 168
Iowa City, IA 52243-0168

Differential Effects of Using ACT® College Readiness Assessment Scores and High School GPA to Predict First-Year College GPA among Racial/Ethnic, Gender, and Income Groups

Edgar I. Sanchez

Abstract

This study examines the differential effects on student subgroups of using the ACT® College Readiness Assessment Composite (ACTC) score and high school grade point average (HSGPA) for making admission decisions. The subgroup characteristics investigated include race/ethnicity, gender, and income. For each student subgroup, we examine the effect of using a total group cut point for ACTC score, HSGPA, or both to predict first-year college grade point average (FYGPA) and the estimated effects of using these predictors to make admission decisions.

The data for the study consisted of over 137,000 first-year entering students from 259 two- and four-year institutions and over 498,000 nonenrolled students. The present research estimates the probability of attainment of a specific level of success in college. We also utilize validity statistics at specific cutoff values to evaluate the effects on dichotomous outcomes.

Across student subgroups, the joint use of ACTC score and HSGPA resulted in greater prediction accuracy than when either predictor was used alone. Furthermore, the use of a total-group cutoff score for both ACTC score and HSGPA slightly overpredict the probability of success of Hispanic and African-American students, males, and lower-income students. Both ACTC score and HSGPA slightly underpredict the probability of success of White students, females, and higher-income students. These findings suggest, therefore, that African American, Hispanic, and lower-income students are not disadvantaged by the use of a total-group cutoff for making admission decisions.

Acknowledgments

The author thanks Julie Noble, Justine Radunzel, and Richard Sawyer for their helpful comments and suggestions on earlier drafts of this report.

Differential Effects of Using ACT® College Readiness Assessment Scores and High School GPA to Predict First-Year College GPA among Racial/Ethnic, Gender, and Income Groups

Historically postsecondary institutions have been interested in increasing the academic preparation and diversity of their incoming freshman class (Breland, Maxey, McLure, Valiga, Boatwright, Ganley, & Jenkins, 1995). They are attempting to do this within the continually ebbing and flowing institutional context of societal and applicant trends, the values emphasized by stakeholders, power to affect change, and legal, financial, or other constraints (Bean, 1990). Typically, postsecondary institutions consider grades in college preparatory courses, strength of curriculum, standardized admission test scores, and overall high school grade point average (HSGPA) along with other non-academic measures (Clinedinst, Hurley, & Hawkins, 2011) to select students to attend their institution. As discussed by Sawyer (2013), the criteria admission offices use to define success at their institution may vary depending upon institutional need and their mission. Admission offices are, in practical terms, looking for tools that will help them correctly and equitably identify and admit students into their institutions that are likely to have a successful postsecondary career at their institution.

Some authors have contended that standardized admission tests unfairly disadvantage particular racial/ethnic, gender, and income groups, and that they have weak predictive power (Atkinson and Geiser, 2011, FairTest, 2007). Partially as a response to these statements, some institutions have adopted alternative admission criteria. These institutions may require standardized test scores if other academic criteria are not met, use standardized test scores for course placement, or may use standardized test scores for certain applicant populations (Milewski & Camara, 2002). Alternatively, institutions may consider standardized test scores only if applicants choose to submit them (Wake Forest University, 2012; Sarah Lawrence

College, 2012) or may allow students to submit a variety of standardized test scores (Hamilton College, 2012).

Regardless of how assessments are used, it is necessary for developers to continually document their appropriateness for both the population and population subgroups (American Educational Research Association (AERA), 1999). Prior research has addressed some of these concerns (Young, 2001). Research related to informing admission decisions should respond to perceived bias and assist postsecondary institutions make more informed admission decisions. This can be done by examining not only the statistical strength of individual predictors with postsecondary outcomes but also the usefulness of and potential differential effects of using pre-college measures for making admission decisions.

Sawyer (2013) investigated the utility of using HSGPA and the ACT Composite (ACTC) score to make admission decisions for the purpose of maximizing academic success and accurately identifying potentially successful applicants. The results suggested that HSGPA is more useful than admission test scores in situations involving low selectivity in admission and minimal to average academic performance in college. In contrast, test scores are more useful than HSGPA in situations involving high selectivity and high academic performance. In nearly all contexts, test scores had incremental usefulness beyond HSGPA.

Prior research has also investigated the perceptions of bias in standardized testing, as well as the advocacy for the use of HSGPA alone for admission decisions. For example, research conducted by the College Board found that the SAT tends to underpredict FYGPA for females and overpredict FYGPA for racial/ethnic minority students (Mattern, Patterson, Shaw, Korbin, & Barbuti, 2008). They further found that the SAT was more predictive of FYGPA for females than males and for White students than other racial/ethnic subgroups.

Noble (2003) examined the validity of using ACTC score, HSGPA, or both for making admission decisions for African American, Hispanic, and White students. Using hypothetical cutoffs based on optimal predictions of success for making admission decisions, the author compared prediction accuracy across subgroups and predictors. When HSGPA was used as the sole predictor of FYGPA, African American, Hispanic, and White students with the same HSGPA did not have the same probability of attaining a FYGPA of 2.5 or higher. In fact, HSGPA overpredicted success for African American and Hispanic students. While a similar overprediction occurred when ACTC score was used, the magnitude of the overprediction was not as great. Moreover, for the three racial/ethnic groups studied, when ACTC score and HSGPA were used in combination, the estimated percentage of students for whom a correct admission decision was made was increased relative to using either measure alone.

Sawyer (1985) examined the differential prediction of HSGPA and ACTC score on FYGPA among gender, racial/ethnic, and age groups. This study examined students from the graduating classes of 1974, 1975, and 1976. Among other findings, this study found that FYGPA for African American and Hispanic students was slightly overpredicted relative to White students.[1] Additionally, FYGPA for female students was slightly underpredicted relative to male students.

As further explained by Young (2001), it is apparent from previous research that subgroup differences do, in fact, occur in validity and prediction. Moreover these differences can vary considerably both between and within racial/ethnic subgroups. Young further proposes that minority student may experience difficulty in adjusting to postsecondary institutions because of Anglo-centric campus environments. In regard to gender differences, Young states that

[1] In the graduating classes of 1974, 1975, and 1976 the ACT Student Profile Section designated “Mexican American/Chicano” and “Puerto Rican or Spanish-Speaking American.” Sawyer (1985) used students who self-identified as “Mexican American/Chicano.” In the 2010-11 academic year, race/ethnicity values were changed to comply with federal reporting guidelines.

observed differences may be due to college and major selection differences, differential grading practices, and gender bias in standardized test score meaning.

As explained by the College Board (1997), these subgroup differences are not an inherent indication of problematic testing programs. Simple geographic and demographic differences contribute to these types of population subgroup differences in performance. Additionally, prior coursework, aspirations, and differing educational opportunities might contribute to observed subgroup differences. The presence of these observed differences may in fact speak more to factors unrelated to the testing program being examined than with problematic features of a given standardized test.

The present research provides an updated and more comprehensive investigation of differential effects on student subgroups of using ACTC score or HSGPA to predict FYGPA. Specifically, the work of Sawyer (2013) is expanded from examining the incremental validity of the use of the ACT scores beyond HSGPA for making admission decisions by investigating these effects across student subgroups to ensure equity in the admission process. This investigation into racial/ethnic and gender differences provides an update to more current data sources and/or methodology from Sawyer's (1985) and Noble's (2003) studies. Furthermore, the present study will take a first look at the differential prediction of ACTC score and HSGPA for making admission decisions across income levels.

This study therefore addresses two fundamental questions for student subgroups regarding the use of hypothetical total-group cutoffs for ACTC score and HSGPA to predict FYGPA for informing admission decisions:

1. Do the probabilities of attaining successive levels of FYGPA differ across student subgroups?

2. Do the estimated effects of using these predictors to make admission decisions differ across student subgroups?

Although two-year institutions traditionally have open admission policies that do not require minimum levels of standardized test scores or HSGPA, about one-fifth use standardized test scores and HSGPA in a counseling context during the admission process (Breland, Maxey, Gernand, Cumming, & Trapani, 2002). Faced with constraints on their financial support, some two-year institutions might in the future be required to restrict enrollment to students who are likely to complete a two-year program or transfer to a four-year institution (González, 2012). Additionally, two-year institutions are being encouraged to evaluate intermediate outcomes as a way of measuring degree progress and increasing degree completion rates (Moore, Shulock, & Offenstein, 2009). With these factors in mind, the current study applies the same methodology to both two- and four-year institutions in order to evaluate the use of ACTC score and HSGPA for identifying students who are likely to be successful in the first year of college.

Data

The data for the study included 259 two- and four-year institutions participating in ACT's® Prediction Research Service or in special research projects (Sawyer, 2013). The data consisted of over 137,000 first-time entering students in the 2003-2004 (< 1%), 2004-2005 (36%), 2005-2006 (61%), and 2006-2007 (3%) academic years.[2] FYGPA was provided by the institutions themselves. HSGPAs were based on students' self-report of grades from a possibility of 23 high school courses in English, mathematics, Social Studies, and Science; students provided the information at the time they registered for the ACT.

The present study examined racial/ethnic, gender, and income subgroups. For race/ethnicity, White, African American, and Hispanic students were investigated. Other races

[2] Entering freshman class percentages do not sum to 100% due to rounding.

were not included in the analysis because of subgroup sample size limitations. For income, students were classified as less than $36,000, $36,000 to $60,000, or greater than $60,000. Race/ethnicity, gender, and income were provided by students at the time they registered for the ACT.

In order for individual students to be included in the analysis, students must have had at least one valid the ACT record in the three years prior to entering a postsecondary institution. A minimum subgroup sample size of 10 was required for inclusion of a postsecondary institution.[3]

Most of the 259 institutions in the sample were four-year public institutions and had a small percentage of African American and Hispanic students (see Table 1). There were equal percentages of institutions with either traditional or liberal/open admission policies. The majority of institutions were from the North Central or Southern accrediting regions.

[3] A minimum sample size restriction was implemented to aid in stabilization of institution-specific model coefficients as well as to allow greater intra-institution variability on the student demographic variables being investigated.

Table 1

Institution Characteristics

Characteristic	
Median undergraduate enrollment	2,403
Median percentage African American and Hispanic	12
Median average the ACT Composite score	21.5
Median average HSGPA	3.3
Percent four-year	74
Percent public	68
Selectivity (in percent)	
Selective/highly selective	17
Traditional	37
Liberal/Open	37
Unknown	8
Accrediting Region (in percent)	
North Central	59
Southern	32
Northwestern	3
Middle States	3
New England	2
Western	1
Unknown	1

Note. Percentages may not sum to 100% due to rounding. Reprinted from the ACT Institutional Data Questionnaire. Data for gender and income were not available from the Institutional Data Questionnaire.

Because it was not possible to construct the true applicant pool for these institutions, an approximate pool was developed. This pool included all students from the identified years who sent an ACT score report to at least one of the 259 institutions, but did not enroll there, plus the students who did enroll there. While it is possible that some of the nonenrolled students did not formally apply for admission to the institutions to which they sent their scores, it was not possible to distinguish the non-applicants from actual applicants. It is also possible that some applicants to these institutions did not submit an official ACT score report. For the purposes of the analyses in this paper score senders are treated as applicants.

Mean ACT Composite scores and mean HSGPA values were computed by institution. Means were calculated for enrolled students, as well as for students in the entire applicant pool. Two different FYGPA outcomes were examined in this study: attainment of a 2.5 or higher FYGPA or attainment of 3.0 or higher FYGPA. These FYGPA values approximately correspond to the 30^{th} and 50^{th} percentiles, respectively, of observed FYGPA. The percentage of enrolled students with a FYGPA of 2.5 or higher and 3.0 or higher was also calculated by institution. Distributions of these means and percentages were then summarized across institutions using minimum, median, and maximum values. Similar analyses were conducted for each racial/ethnic, gender, and income group. Multiple cohorts of students at an institution were combined for the analyses.

As was the case for Noble (2003), the analyses were limited to success levels of 2.5 or higher, and 3.0 or higher, FYGPA. The relatively small proportion of students achieving a FYGPA of less than 2.5 at many institutions resulted in considerably fewer institutions producing viable models. The 2.5 or higher and 3.0 or higher success levels were therefore selected to maximize the number of institutions in both samples for which models could be developed.

The total applicant pool consisted of over 137,000 enrolled and over 498,000 nonenrolled students. Typical values across institutions for the total applicant sample were similar to those for enrolled ACT-tested freshmen nationally between 2004 and 2007 (ACT, 2004, 2005, 2006, 2007) on median average ACTC score, percentage of students taking a core curriculum, and percentages of lower-, middle-, and higher-income students (see Table 2). Students in both the enrolled and total applicant samples tended to have higher HSGPAs, on average, than enrolled ACT-tested students nationally. While the median average ACTC score for enrolled ACT-tested students nationally and that for the total applicant sample were similar, both were lower than that of the enrolled students from the study sample. The enrolled sample typically had a greater percentage of core-taking students' and middle- and higher-income students than either the applicant sample or enrolled ACT-tested students nationally. Both the enrolled and total applicant samples typically had a greater median percentage of male students and a smaller median percentage of female students than enrolled ACT-tested students nationally.

Table 2

Summary, across Institutions, of Sample Size and Average Student Characteristics

	Enrolled students			Applicants			Enrolled students nationally**		
Characteristic	**Median**	**Minimum**	**Maximum**	**Median**	**Minimum**	**Maximum**	**Median**	**Minimum**	**Maximum**
Sample size	1,311	14	5,975	8,357	46	35,537	1,092	4	86,510
Mean HSGPA	3.4	2.0	3.8	3.4	2.6	3.7	3.0	1.8	3.7
Mean ACTC	22.0	15.0	28.7	20.8	14.0	26.7	20.9	14.9	29.8
Mean First year GPA	2.7	1.5	3.6	N/A	N/A	N/A	N/A	N/A	N/A
Percent African American and Hispanic	12	0	100	16	2	99	11	0	97
Percent taking core curriculum	75	32	90	67	24	81	67	14	92
Percent meeting success level									
Percent with FYGPA of 2.5 or higher	69	1	100	N/A	N/A	N/A	N/A	N/A	N/A
Percent with FYGPA of 3.0 or higher	48	1	96	N/A	N/A	N/A	N/A	N/A	N/A
Race/ethnicity (in percent)									
White	78	0	100	76	1	95	79	0	100
African American	6	0	96	8	0	92	6	0	93
Hispanic	2	0	51	2	0	57	2	0	66
Gender (in percent)									
Male	57	21	97	54	18	96	42	0	100
Female	40	0	78	44	2	82	56	0	100
Unknown	1	0	9	2	0	7	1	0	13
Income (in percent)									
Less than $30,000	17	4	69	19	7	66	17	0	65
$30,000 to $60,000	38	23	60	29	14	42	30	0	52
More than $60,000	43	6	66	33	5	49	31	0	100
Unknown*	0	0	0	18	11	41	19	0	62

*Missing income range was imputed for enrolled students
**Data for students from national ACT Class Profile Reports (2004, 2005, 2006, and 2007).
N/A = Data not available.

Table 3 summarizes the distribution of the correlations of the pre-college variables and FYGPA across the 259 institutions in the sample. Typically, HSGPA had a higher correlation with FYGPA than ACTC score. The minimum and maximum correlations observed across institutions demonstrate significant variation in the correlations at the institutions in the sample. At two institutions both ACTC score and HSGPA were negatively correlated with FYGPA, however the correlations were not significant. ACTC score and HSGPA typically accounted for 23% of the variance in FYGPA however there was considerable variation in R^2 values across institutions.

Table 3

Enrolled Student Correlations among Institutions

Correlation	Median	Minimum	Maximum
HSGPA/ACTC	0.43	0.07	0.67
FYGPA/HSGPA	0.43	-0.09	0.74
FYGPA/ACTC	0.36	-0.09	0.62
FYGPA/HSGPA & ACTC multiple R	0.48	0.06	0.78
FYGPA/HSGPA & ACTC multiple R^2	0.23	0.00	0.60

Across racial/ethnic, gender, and income subgroups, and institutions, median average ACTC scores and HSGPAs for the enrolled sample were generally higher than those for the applicant sample (see Table 4). Relative to all enrolled ACT-tested students nationally, students in the enrolled sample typically had slightly higher median ACTC scores and HSGPA, on average. Students in the applicant sample, on the other hand, tended to have lower median ACTC scores and higher HSGPAs, on average, than all enrolled ACT-tested students nationally.

Table 4

Median Student Characteristics across Institutions by Subgroup

		Enrolled students				Applicant pool		Enrolled students nationally[*]	
		Mean		Percent with FYGPA of		Mean		Mean	
Characteristic	**Statistic**	**ACTC**	**HSGPA**	**2.5 or higher**	**3.0 or higher**	**ACTC**	**HSGPA**	**ACTC**	**HSGPA**
White	Med.	21.9	3.3	71	50	20.6	3.3	21.6	3.0
	Min.	17.7	1.8	0	0	16.9	2.7	13.0	1.8
	Max.	29.4	3.8	100	99	26.8	3.7	30.6	3.7
African American	Med.	17.7	3.0	42	19	18.5	3.1	17.4	2.7
	Min	13.0	1.8	0	0	11.3	2.0	11.0	0.0
	Max	27.0	4.0	100	100	25.3	3.9	27.0	3.6
Hispanic	Med.	20.0	3.2	60	36	17.8	3.1	19.8	2.9
	Min	12.0	1.9	0	0	10.0	1.4	11.0	0.0
	Max	27.0	3.9	100	100	25.3	3.8	28.0	4.0
Female	Med.	21.1	3.4	71	52	20.1	3.2	21.0	3.1
	Min.	14.8	2.6	1	1	14.3	2.6	15.4	0.0
	Max.	28.7	3.8	100	96	27.0	3.7	29.5	3.7
Males	Med.	21.1	3.2	60	38	19.2	3.1	20.9	2.8
	Min.	15.1	1.7	2	0	13.3	2.5	14.4	1.8
	Max.	28.7	3.8	100	95	0.0	0.0	30.2	4.0
Lower-income (<$30K)	Med.	20.0	3.2	59	37	18.1	3.1	19.6	2.9
	Min.	13.4	2.2	0	0	13.8	2.5	14.9	1.3
	Max.	26.9	3.8	100	100	22.8	3.5	28.7	0.3
Middle-income ($30K - $60K)	Med.	21.2	3.3	67	46	20.0	3.2	21.0	3.0
	Min.	15.0	2.0	1	0	14.5	2.5	14.1	1.9
	Max.	28.6	3.8	100	94	25.5	3.6	29.4	0.3
Higher-income (> $60K)	Med.	21.7	3.3	73	51	20.9	3.3	21.7	3.0
	Min.	15.1	1.8	1	0	15.7	2.6	14.4	0.0
	Max.	29.1	3.8	100	98	27.5	3.7	30.5	0.3

[*]Data for students from ACT Class Profile Report (2004, 2005, 2006, and 2007).

While females had higher median average ACTC scores and HSGPAs than males in the total applicant sample and higher median average HSGPA values for enrolled students, the median average ACTC score for enrolled male and female students was the same. For the total applicant sample and among enrolled students, higher-income students tended to have the highest median average ACTC score and HSGPA values across institutions, followed by middle-income students, and then finally by lower-income students. Median ACTC score and HSGPA were higher for White students in both student groups than for African American and Hispanic students.[4]

In the enrolled sample, a greater percentage of female students than male students, on average, had a FYGPA of either 2.5 or higher, or 3.0 or higher. As income increased, the typical percentage of students with a FYGPA of 2.5 or higher, or 3.0 or higher increased. Additionally, a greater percentage of White students than either African American or Hispanic students had a FYGPA of 2.5 or higher or 3.0 or higher.

Method

The present research used the methods developed by Sawyer (1996) for validating educational selection decisions; the method frames validity evidence in terms of probable outcomes, given the predictors and outcome criteria used.

Two general types of hierarchical logistic regression models were estimated for predicting attainment of two successive levels of FYGPA. The first was a total-group regression model, consisting of ACTC score, HSGPA, or ACTC score and HSGPA used jointly. The second was a model consisting of a demographic indicator for racial/ethnic group, gender, or income level, ACTC score, HSGPA, or ACTC score and HSGPA used jointly, and the interaction between the demographic indicator(s) and the achievement predictors. Separate models were estimated for African American vs. White students and Hispanic vs. White students.

[4] The average ACTC score and HSGPA for African American students may have been higher for the total applicant sample than for the enrolled sample because of the relatively small median N count at the institutions sampled; the median number of African American students across institutions was 95.

Hierarchical models account for variability across colleges in order to draw correct conclusions about predictor-outcome relationships. In this study, we allowed the intercepts and slopes of the main effects to vary randomly across institutions. The slopes of the demographic indicator and achievement interactions were included as fixed effects only.

The interaction between ACTC score and HSGPA in the total-group joint models for both FYGPA success levels were not statistically significantly different from zero ($p \approx 0.99$ for both success levels). Therefore, we did not include an ACTC-by-HSGPA interaction in the models. In a study involving only four-year institutions, Sawyer (2013) found a large interaction effect. One likely reason for the different results is that in the present study, we examined both two-year and four-year institutions, rather than only four-year institutions.

Differential Prediction

Differential prediction occurs when students who have the same test scores, but belong to different population groups, have different probabilities of success. In this study, we examined differential prediction by comparing the estimated probability of attaining specific levels of FYGPA among different groups.

In practice, when institutions make predictions about the success of their applicants, if they are admitted and enrolled, they may consider numerous factors including cognitive and non-cognitive factors. ACT does not advocate making college success predictions solely on the basis of a single measure, such as a test score. This paper examines the accuracy of predictions based on two predictors, HSGPA and the ACT Composite score, and on the incremental contribution of each to ameliorating over- and underprediction. The methods used here can also be generalized to multiple predictors.

Differential Validity

One of the effects of differential prediction is that if an institution used cutoff scores based on students' probability of success to make admission decisions, different aggregate results could result for different population groups. For example, predictive correlations could differ among the groups. Or, the proportion of admitted applicants who are successful (success rate) and the proportion of correct admission decisions (accuracy rate), could differ. We refer to such differences as differential validity.

Postsecondary institutions do not utilize strict score cutoff values as those used in the present study. The use of strict cutoffs in the present study is a mathematical idealization intended to provide guidance to postsecondary institutions as they decide how best to make admission decisions.

Validity statistics were generated from the hierarchical logistic models and frequency distributions of ACTC score and HSGPA to determine the effectiveness of these measures for making postsecondary admission decisions. For each of the predictors investigated, alone or in combination, three validity statistics were calculated per institution using the institution specific total-group optimal cutoff : accuracy rate (AR), success rate (SR), and increase in accuracy rate (ΔAR). [5]

For each institution and success level, optimal cutoffs that maximized prediction accuracy for FYGPA were identified for the ACTC score, HSGPA, and joint ACTC/HSGPA models using a total-group model. The cutoffs were used in order to simulate the effects of making admission decisions based on ACTC score and/or HSGPA on student subgroups.

The accuracy rate is the estimated percentage of students for whom a correct admission decision is made. Accuracy rates are based on those students who would be admitted and be

[5] See Sawyer (2013) for methodological details.

successful as well as those students who would not be admitted and not have been successful, had they been admitted, given the optimal cutoff. The success rate is the estimated percentage of students who, if enrolled based on some optimal cutoff, would be successful. The increase in accuracy rate or incremental utility is the difference between using the given cutoff for the predictor(s) to make admission decisions and admitting all applicants (i.e. not using the predictor(s)). If no selection procedure were used (i.e., if all students were admitted), a certain percentage would be successful. This percentage is referred to as the "baseline" accuracy rate. The arithmetic difference between the maximum accuracy rate and the baseline accuracy rate represents the increase in accuracy rate (ΔAR) that results from using test scores and/or HSGPA for making admission decisions.

It can be shown that optimal cutoffs also correspond to a 0.50 probability of success for a given model. For the ACTC score and HSGPA joint model, multiple combinations of ACTC score and HSGPA cutoffs corresponding to a probability of success of 0.50 can be identified. Probability distributions that cross 0.50 will yield accuracy rate distributions that increase to a maximum and then decrease. If the probability distribution for an institution does not cross 0.50, the maximum accuracy rate and optimal cutoff indicate that the selection criteria are not useful, and the model is therefore considered a "nonviable" model for an institution. Models for institutions with probability curves crossing 0.50 are referred to here as "viable" models.

For each model investigated, the number of institutions producing viable models varied. The results presented are limited to institutions that produced viable models for the three predictor models examined (i.e. ACTC score, HSGPA, and joint ACTC score and HSGPA models). In the 2.5 or higher and 3.0 or higher success models, 253 and 247 institutions, respectively, produced viable models.

Total-group and subgroup validity statistics were based on the institution's own frequency distribution of predictor variables and summarized across institutions using median values. Results for each model were based on using the institution specific total-group cutoffs and applying the cutoff to the subgroup-specific probability and frequency distribution for each institution. These values were used to compare subgroups in order to examine the differential usefulness in making admission decisions. Typical values of the validity statistics at the total-group optimal cutoffs were compared across student subgroups.

Results

Total-group Results

This section presents the median probabilities of success and validity statistics for the total-group analysis based on ACTC score and HSGPA values, alone and in combination, across institutions with viable models. Results for these models, which did not include student characteristics as predictors, serve as comparative baselines for evaluating the results presented for student subgroups.

Table 5 includes the validity statistics that were calculated for the two FYGPA levels, based on total-group models. Results presented include: number of institutions with viable models (N), optimal cutoffs (OC), maximum accuracy rate (AR), increase in AR (ΔAR), success rate (SR), and observed percentage of students below the optimal cutoff (PB). The joint usage of ACTC score and HSGPA resulted in a higher median values for maximum AR, ΔAR, and SR for both success levels than using either predictor alone.[6]

[6] Readers interested in further information about the incremental validity of ACTC score and HSGPA are referred to Sawyer (2013).

Table 5

Median Validity Statistics, Across Institutions, for Predicting Specific Levels of FYGPA

Predictor variable	N	Optimal cutoff (OC)	Maximum Accuracy rate (AR)	Increase in AR (ΔAR)	Success rate (SR)	Observed percentage below OC (PB)
			Median (Min/Max)	Median (Min/Max)	Median (Min/Max)	Median (Min/Max)
2.5 or higher FYGPA						
ACTC	253	18	70 (57/91)	8 (0/56)	70 (57/91)	30 (0/94)
HSGPA		2.8	72 (57/91)	9 (0/52)	72 (51/91)	29 (0/95)
ACTC & HSGPA			73 (57/90)	13 (0/56)	74 (57/91)	34 (0/86)
3.0 or higher FYGPA						
ACTC	247	23	72 (63/92)	31 (0/81)	67 (52/93)	70 (0/99)
HSGPA		3.4	73 (56/94)	31 (0/65)	65 (51/96)	63 (0/98)
ACTC & HSGPA			76 (61/94)	36 (0/82)	69 (52/95)	66 (0/99)

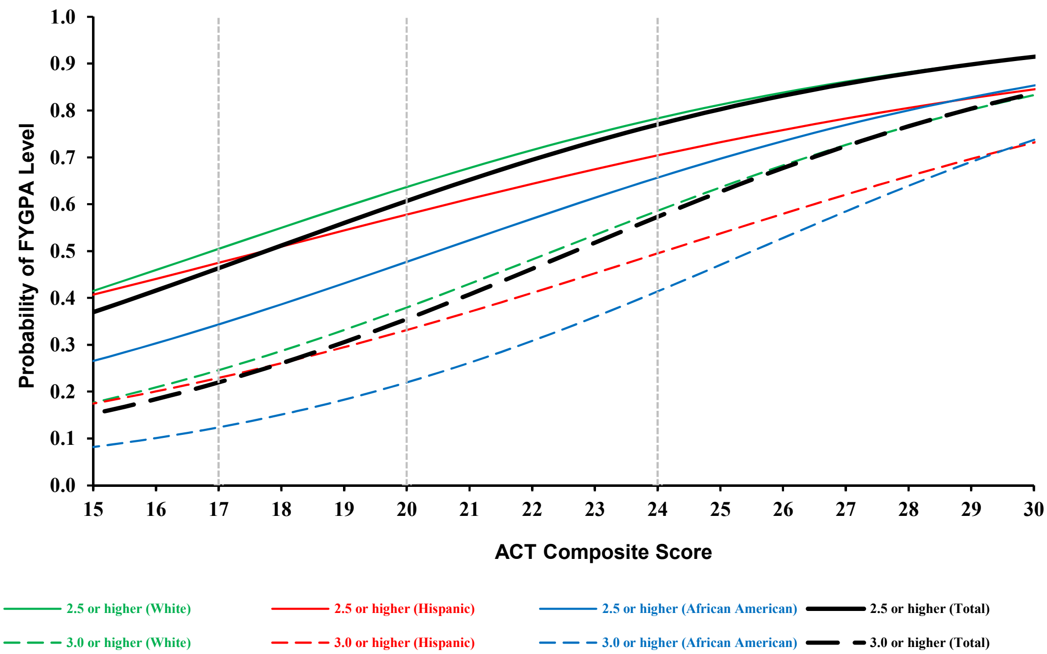
Note: Multiple combinations of ACTC score and HSGPA correspond to a 0.50 probability of success for the joint models.

As the success level increased, the number of institutions with viable models decreased. The optimal cutoffs for both ACTC score and HSGPA also increased as the success level increased.

Subgroup Differential Effects

In this section the probabilities of success and validity statistics associated with using the total-group cutoff for predicting FYGPA are presented for each of the student demographic subgroups.[7] Results are presented first for race/ethnicity, followed by gender, and finally income. For each subgroup, comparisons to the total-group probabilities are presented to illustrate further the differential effect of using a total-group cutoff for ACTC score, HSGPA, or both to predict FYGPA.

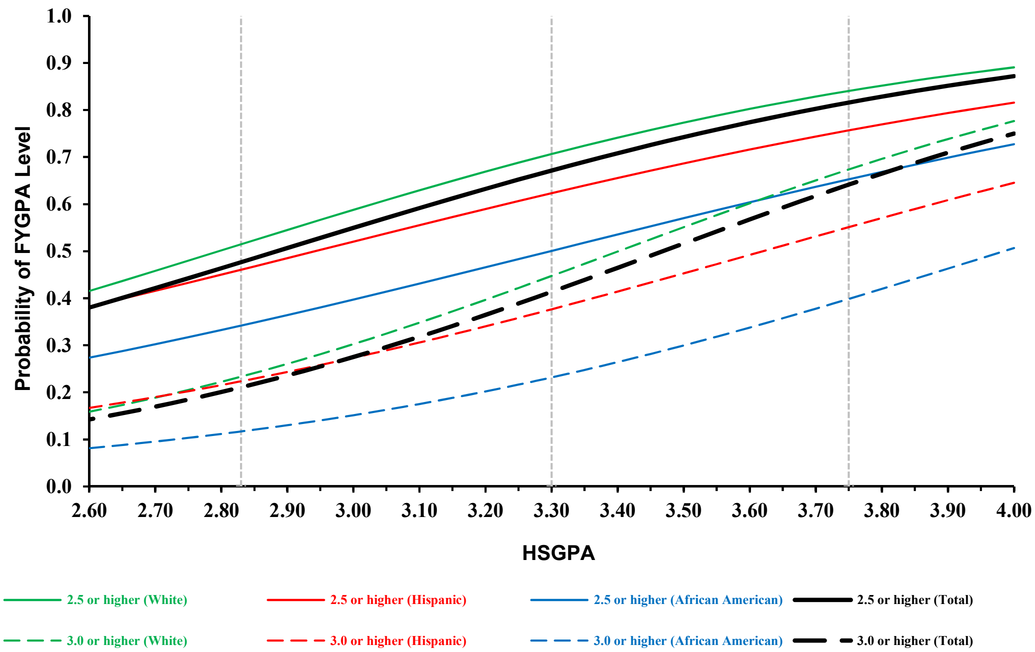
Race/Ethnicity. For White, African American, and Hispanic students, as ACTC score or HSGPA increased, the probability of success also increased (Figure 1 and Figure 2). For the two FYGPA levels, White students had higher estimated probabilities of success than African American and Hispanic students over most of the ACTC score and HSGPA scales, and Hispanic students tended to have higher estimated chances of success than African American students.



Note: The three vertical reference lines represent the first, second, and third quartiles.

Figure 1: Estimated probabilities of achieving specific FYGPA levels based on ACTC score, by race/ethnicity.

[7] Probabilities of success presented in these sections are based on the fixed effect parameter estimates from hierarchical logistic models.



Note: The three vertical reference lines represent the first, second, and third quartiles.

Figure 2: Estimated Probabilities of FYGPA Achievement Based on HSGPA, by Race/ethnicity

For both success levels, differences in probabilities between African American and White students tended to be of greater magnitude than the differences between Hispanic and White students at ACTC scores below 29. Differences in estimated probabilities between African American and White students scoring between the first and third ACTC score quartiles (17 and 24, respectively) for the two FYGPA success levels were, at most, 0.16. Estimated probabilities of success for Hispanic students were, at most, 0.06 lower than those for White students.

Conversely, as HSGPA increased, differences between estimated probabilities for White students and both African American and Hispanic students tended to increase. On average, estimated probabilities for African American and Hispanic students scoring between the first and third HSGPA quartile (about 2.8 and 3.8, respectively) for both success levels were, at most, 0.21 lower than those of White students. For Hispanic students these probabilities were, at most, 0.08, lower than those of White students. The differences between African American and White students were larger in magnitude than those based on the ACTC score model, particularly at the 3.0 or higher success level.

Using ACTC score as the sole academic predictor of success, the difference in the estimated probabilities between the total-group model and the probabilities for White students generally decreased slightly as ACTC score increased. Additionally, as the success level increased, this underprediction decreased in magnitude for the same ACTC score. For African American and Hispanic students the under- and overprediction by the total-group tended to be smaller at the upper and lower extremes of the ACTC score scale and larger in the middle of the scale. In contrast to White students, as the success level increased, the magnitude of overprediction for African American and Hispanic students tended to increase slightly for similar ACTC scores.

When HSGPA was used as the sole predictor of success, the differences in probabilities between the total-group model and White students were similar across levels, never exceeding a difference of 0.04. The differences in probability estimates for African American and White students in the 2.5 or higher success level tended to increase across much of the HSGPA scale. For African American students in the 3.0 or higher success level and for Hispanic students at both success levels, these differences tended to increase as HSGPA increased.

Where differences in over- and underprediction of success existed, they tended to be of greater magnitude when HSGPA was used as the academic predictor then when ACTC score was used (see Figure 2). This was particularly notable for African American students scoring above a HSGPA of about 3.0. This suggested a total-group HSGPA model considerably overestimates the chances of success for African American and Hispanic students with a high HSGPA.

The median probabilities of success across institutions based on a total-group cutoff for racial/ethnic groups tended to show a pattern of underprediction for white students and over prediction for both Hispanic and African American students (see Table 6). Across institutions, for the 2.5 or higher success level, Hispanic students showed the least amount of overprediction. African American students, however, showed evidence of moderate overprediction. For the 3.0 or higher success level, the overprediction observed for minority groups increased in magnitude. This was most dramatically seen for African American students.

Table 6

Median Statistics for Predicting Specific Levels of FYGPA by Ethnicity Across Institutions

Predictor Variable	N	Total-group Cutoff	Race/ ethnicity	Subgroup-specific probability of success Median (Min/Max)	Maximum Accuracy Rate (AR) Median (Min/Max)	Increase in AR (ΔAR) Median (Min/Max)	Success rate (SR) Median (Min/Max)	Observed percentage below OC (PB) Median (Min/Max)
2.5 or higher FYGPA								
ACTC		18	White	0.56 (0.29/0.77)	69 (52/97)	5 (-13/50)	72 (52/97)	29 (0/97)
			African American	0.39 (0.19/0.61)	70 (46/93)	37 (0/86)	52 (18/86)	70 (0/100)
			Hispanic	0.51 (0.2/0.71)	65 (54/86)	21 (-13/72)	59 (26/84)	70 (0/100)
HSGPA	242	2.8	White	0.53 (0.07/0.77)	72 (55/96)	6 (-4/50)	74 (51/96)	25 (0/91)
			African American	0.35 (0.07/0.61)	67 (33/90)	29 (-1/81)	51 (11/82)	55 (0/100)
			Hispanic	0.47 (0.23/0.7)	67 (42/84)	19 (-7/69)	62 (18/82)	55 (0/100)
ACTC & HSGPA			White	0.52 (0.1/0.73)	73 (59/97)	10 (-4/57)	75 (52/97)	31 (0/92)
			African American	0.37 (0.11/0.85)	73 (45/94)	42 (0/87)	55 (10/86)	70 (0/100)
			Hispanic	0.48 (0.2/0.73)	70 (55/87)	31 (-11/74)	62 (19/83)	70 (0/100)

Table 6 (*continued*)

Predictor Variable	N	Total-group Cutoff	Race/ ethnicity	Subgroup-specific probability of success Median (Min/Max)	Maximum Accuracy Rate (AR) Median (Min/Max)	Increase in AR (ΔAR) Median (Min/Max)	Success rate (SR) Median (Min/Max)	Observed percentage below OC (PB) Median (Min/Max)
3.0 or higher FYGPA								
ACTC		23	White	0.54 (0.37/0.75)	71 (62/90)	25 (-2/63)	68 (53/90)	66 (1/99)
			African American	0.36 (0.21/0.74)	86 (57/97)	71 (7/93)	46 (7/75)	93 (14/100)
			Hispanic	0.45 (0.32/0.6)	78 (60/91)	56 (2/83)	53 (16/77)	93 (14/100)
HSGPA	236	3.4	White	0.52 (0.23/0.79)	72 (55/87)	22 (0/60)	68 (51/89)	55 (1/98)
			African American	0.27 (0.15/0.51)	81 (43/98)	64 (0/97)	37 (2/66)	85 (0/100)
			Hispanic	0.42 (0.21/0.59)	75 (53/96)	49 (0/92)	52 (4/77)	85 (0/100)
ACTC & HSGPA			White	0.51 (0.36/0.69)	75 (57/90)	30 (1/69)	70 (54/90)	62 (2/97)
			African American	0.32 (0.02/0.61)	87 (61/100)	73 (14/99)	48 (1/87)	92 (19/100)
			Hispanic	0.43 (0.04/0.6)	81 (63/98)	61 (6/96)	55 (3/80)	93 (18/100)

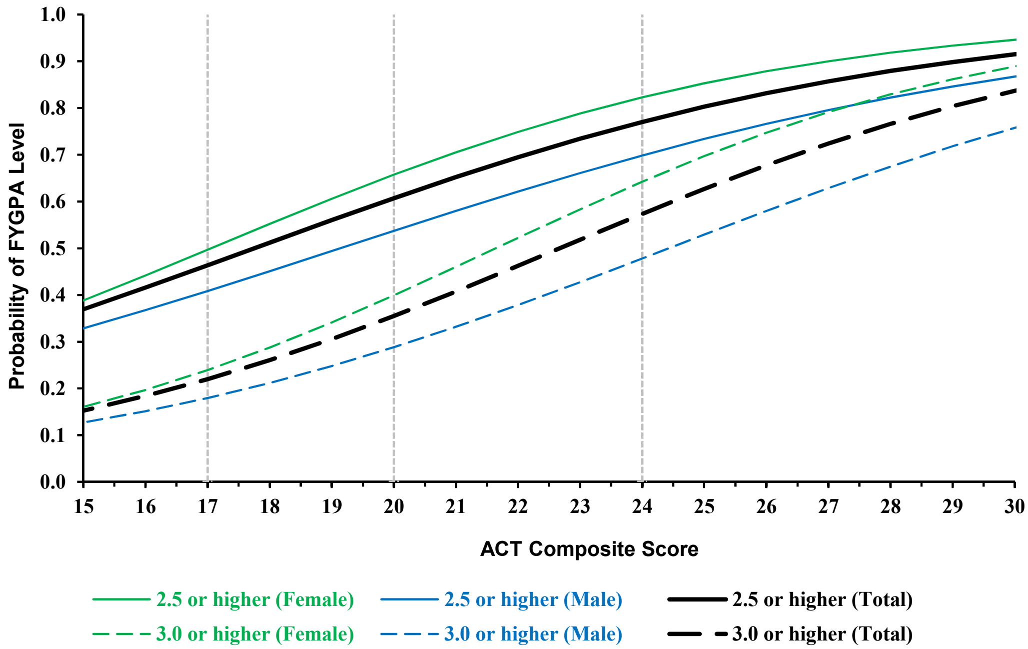
Note: Multiple combinations of ACTC score and HSGPA correspond to a 0.50 probability of success for the joint models.

Table 6 displays the median validity statistics associated with estimating FYGPA success using ACTC score and HSGPA individually and in combination for White, African American, and Hispanic students. The joint ACTC score and HSGPA model tended to produce the most favorable ARs and SRs, on average across the racial/ethnic groups. For the 2.5 or higher FYGPA success level, White students generally had the highest median ARs and SRs. For the 3.0 or higher FYGPA success level, median ARs were highest for African American students, and lowest for White students.

Regardless of the success level or predictor model, White students had the highest typical SRs followed by Hispanic students and finally by African American students. For each racial/ethnic group as the success level increased, typical SRs decreased for all predictor models.

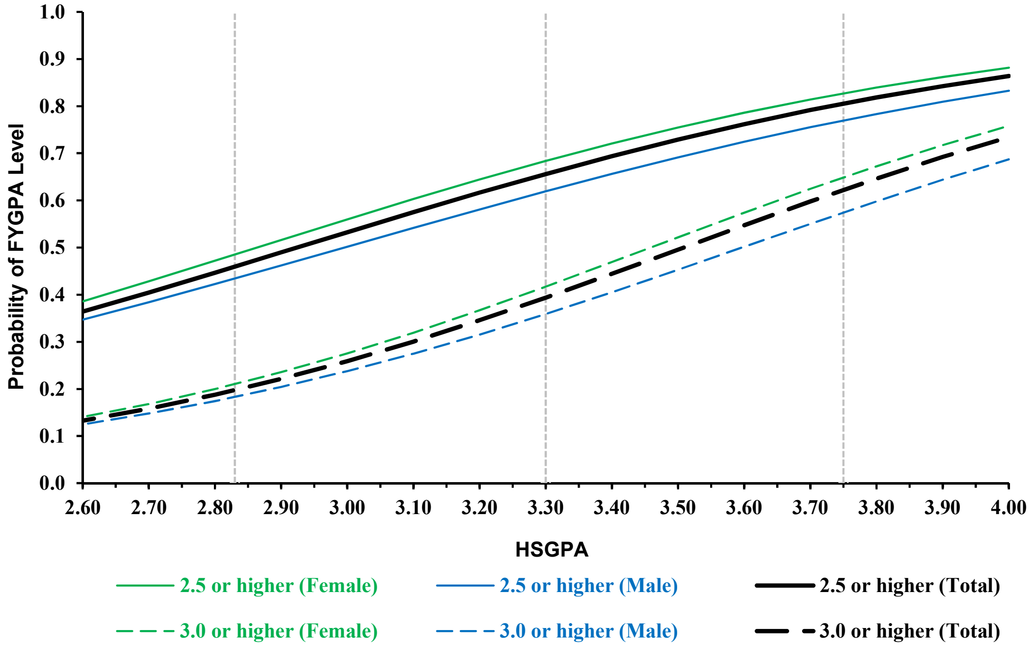
For the 2.5 or higher FYGPA success level, African American students had the highest median AR when ACTC score was used followed by White and then Hispanic students. For the HSGPA model, White students had the highest median AR followed by both African American and Hispanic students. In the joint ACTC score and HSGPA model, White and African American students had the highest median AR followed by Hispanic students. Regardless of the predictor model, for the 2.5 or higher FYGPA success level, White students had considerably fewer students below the total-group optimal cutoff. Regardless of the predictor model, for the 3.0 or higher success level, African American students had the highest median AR followed by Hispanic and then by White students. Additionally, regardless of predictor model, White students had fewer students below the total-group optimal cutoff followed by both African American and Hispanic students. In fact, for the 3.0 or higher success level, most African American and Hispanic students did not meet the total-group cutoff.

Gender. For both males and females, as ACTC score or HSGPA increased, the estimated probability of attaining the two FYGPA success levels also increased (see Figure 3 and Figure 4). Moreover, regardless of level of success examined, female students had a higher probability of success than male students. Differences in probabilities between males and females achieving a FYGPA of 2.5 or higher, or 3.0 or higher, were largest for students with ACTC scores of 21 – 23 and 25 – 30, respectively. These differences in probabilities between males and females were, at most, 0.17. Across the HSGPA scale, the differences in probabilities between female and male students for the two success levels were, at most, 0.07. Differences in probabilities in both the ACTC score and HSGPA models were larger for the 3.0 or higher model than for the 2.5 or higher model. Additionally, there appeared to be a trend of greater overprediction for males than underprediction for females.



Note: The three vertical reference lines represent the first, second, and third quartiles.

Figure 3. Estimated probabilities of achieving specific FYGPA levels based on ACTC score, by gender.



Note: The three vertical reference lines represent the first, second, and third quartiles.

Figure 4. Estimated probabilities of achieving specific FYGPA levels based on HSGPA, by gender.

The estimated probability of success was higher for females and lower for males than the estimates produced by a total-group model over much of the ACTC score and HSGPA scales (see Figure 3 and Figure 4). At the 1st, 2nd, and 3rd quartiles of the ACTC score and HSGPA distributions, as indicated by the three vertical reference lines, the total-group models based on ACTC score and HSGPA underpredicts FYGPA success for female students at both success levels and overpredicts success for male students. As ACTC score increased, the amount of over- and underprediction for the gender probabilities of success tended to increase slightly in magnitude between ACTC scores of about 16 – 27 (maximum absolute difference in gender specific probabilities and total-group probabilities was about 0.10). The absolute differences between the total-group estimated probabilities and the gender-specific estimated probabilities also tended to increase as HSGPA increased, with the largest absolute difference being about 0.05.

The median subgroup-specific probabilities of success across institutions were also calculated for each success level and predictor model (see Table 7). For both success levels, using a total-group cutoff score underpredicted the probability of success for females and overpredicted the probability of success for males. Across institutions, the use of ACTC score alone resulted in slightly larger differential prediction than when HSGPA was used in isolation. These findings are consistent with those previously discussed.

Table 7

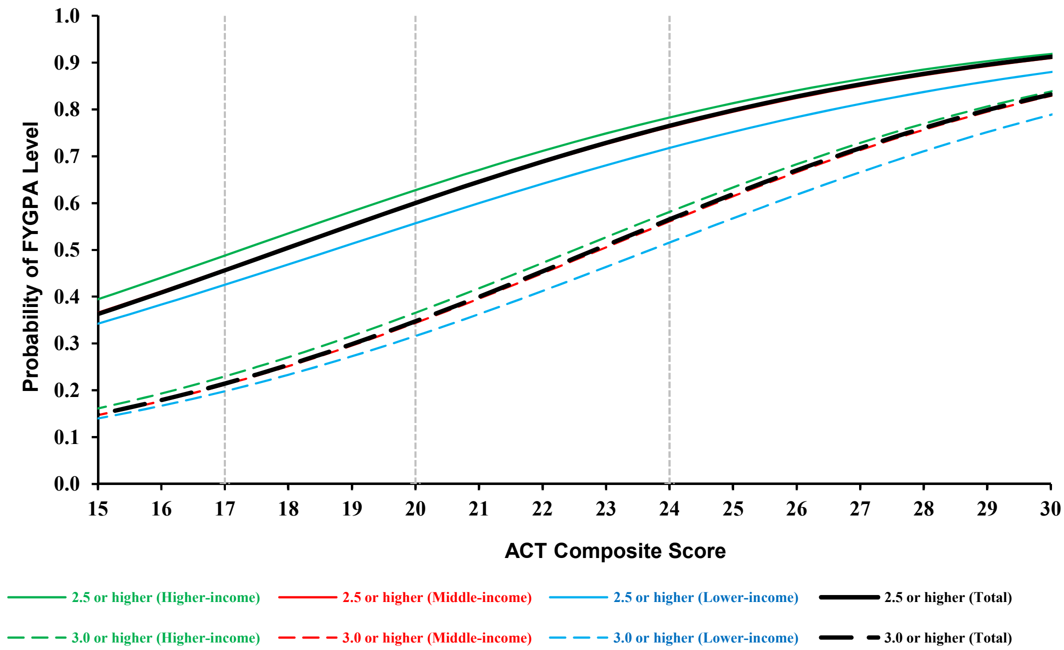
Median Statistics for Predicting Specific Levels of FYGPA by Gender Across Institutions

Predictor Variable	N	Total-group Cutoff	Gender	Subgroup-specific probability of success Median (Min/Max)	Maximum Accuracy Rate (AR) Median (Min/Max)	Increase in AR (ΔAR) Median (Min/Max)	Success rate (SR) Median (Min/Max)	Observed percentage below OC (PB) Median (Min/Max)
2.5 or higher FYGPA								
ACTC		18	Female	0.56 (0.40/0.68)	73 (59/97)	8 (0/64)	75 (58/97)	33 (0/96)
			Male	0.45 (0.33/0.61)	69 (55/92)	16 (0/73)	62 (33/92)	40 (0/100)
HSGPA	253	2.8	Female	0.53 (0.16/0.61)	73 (57/96)	6 (0/51)	75 (53/96)	24 (0/89)
			Male	0.47 (0.18/.059)	70 (56/91)	13 (-1/64)	66 (48/91)	35 (0/94)
ACTC & HSGPA			Female	0.52 (0.07/0.61)	75 (60/97)	12 (0/65)	76 (53/97)	33 (0/93)
			Male	0.45 (0.10/0.57)	72 (57/92)	20 (0/74)	66 (45/92)	44 (0/99)
3.0 or higher FYGPA								
ACTC		23	Female	0.59 (0.36/0.73)	74 (63/92)	27 (0/76)	74 (56/93)	68 (0/99)
			Male	0.43 (0.32/0.57)	74 (59/94)	43 (0/89)	58 (20/91)	74 (0/100)
HSGPA	247	3.4	Female	0.52 (0.32/0.61)	73 (62/93)	24 (0/62)	68 (47/93)	54 (1/98)
			Male	0.46 (0.32/0.54)	74 (59/92)	38 (0/78)	60 (36/94)	66 (1/99)
ACTC & HSGPA			Female	0.53 (0.28/0.6)	77 (66/92)	32 (0/78)	73 (53/93)	62 (0/99)
			Male	0.44 (0.3/0.53)	78 (64/95)	45 (0/90)	62 (32/93)	73 (1/100)

Note: Multiple combinations of ACTC score and HSGPA correspond to a 0.50 probability of success for the joint models.

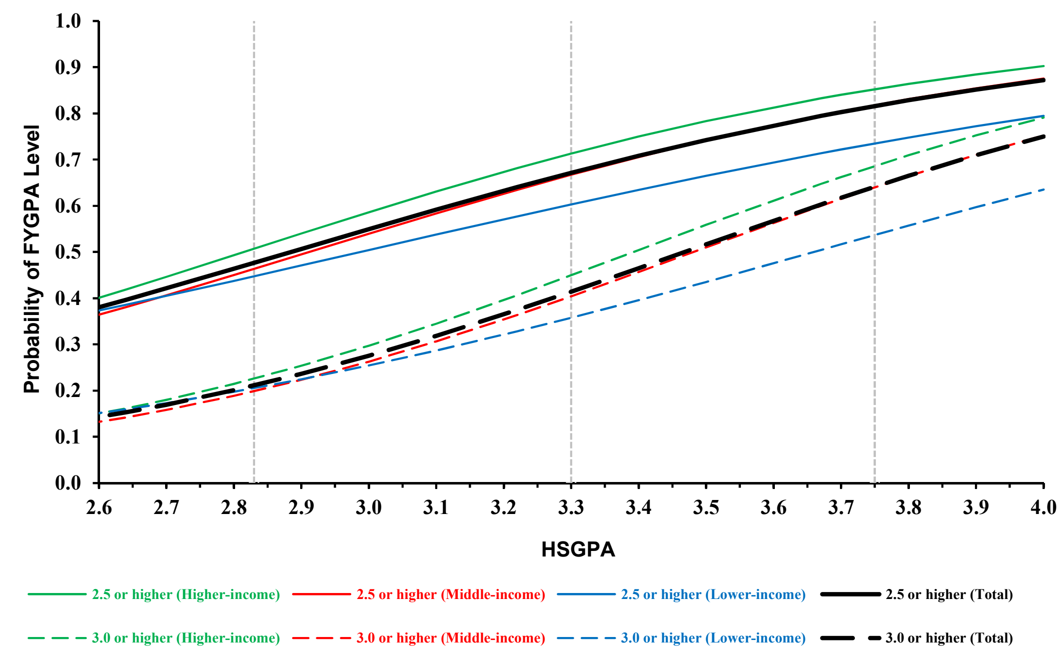
Table 7 further shows the median validity statistics across institutions for the ACTC score, HSGPA, and joint ACTC score and HSGPA models. For the 2.5 or higher success level, using a total-group cutoff resulted in higher median ARs and SRs for female students than for male students, regardless of the predictor combination used. At the 3.0 or higher level, while the median SR was higher for females than for males, median ARs were more similar between males and females. For both success levels, typical ΔARs were considerably larger for males than for females, and a smaller percentage of males were at or above the total-group cutoff than were females. For both success levels the joint ACTC score and HSGPA model tended to produce more favorable ARs and SRs, on average for both males and females.

Income. For lower-, middle-, and higher-income students, as ACTC score or HSGPA increased, the estimated probability of achieving the two FYGPA levels also increased (see Figure 5 and Figure 6). For both success levels, when either ACTC score or HSGPA was used as the sole academic predictor, the estimated probabilities of success for lower-income students tended to be lower than the estimated probabilities for middle-income students, and both tended to be lower than the estimated probabilities of higher-income students.



Note: The three vertical reference lines represent the first, second, and third quartiles.

Figure 5. Estimated probabilities of achieving specific FYGPA levels based on ACTC, by income.



Note: The three vertical reference lines represent the first, second, and third quartiles.

Figure 6. Estimated probabilities of FYGPA achievement based on HSGPA, by income.

In the two ACTC score models, the differences between income levels in estimated probabilities for students scoring between the first and third ACTC score quartile, averaged at most 0.07. As the success level examined increased from 2.5 or higher to 3.0 or higher, the difference in chances of attaining the success level between income levels decreased. Analogous differences between income groups, when HSGPA was used as the predictor, tended to be slightly larger in magnitude. This was most apparent in the differences in estimated probabilities between lower- and higher-income students.

The probability estimates produced by the total-group model tended to be higher than the estimates for lower-income students for the two FYGPA success levels. The opposite tended to be true for higher-income students. For the two success levels, the differences in estimated probabilities for middle-income students and the total-group estimates when HSGPA or ACTC score was used as the sole academic predictor were, at most, about 0.04 and 0.03, respectively.

Where over- and underprediction between the total-group and income specific probabilities existed, the differences tended to be smaller in magnitude when ACTC score was used particularly at higher levels of HSGPA and for the 3.0 or higher success level. This suggested that when ACTC score was used in the model rather than HSGPA over- and underprediction was reduced.

The median probability of success at the total-group cutoff for lower- and higher-income students tended to be over- and underpredicted, respectively (see Table 8). Relatively little evidence of over- or underprediction was observed for middle-income students. These institution based estimates of differential prediction are consistent with the results based on the fixed effects of the hierarchical models previously presented.

Table 8

Median Statistics for Predicting Specific Levels of FYGPA by Income Across Institutions

Predictor Variable	N	Total-group Cutoff	Income	Subgroup-specific probability of success Median (Min/Max)	Maximum Accuracy Rate (AR) Median (Min/Max)	Increase in AR (ΔAR) Median (Min/Max)	Success rate (SR) Median (Min/Max)	Observed percentage below OC (PB) Median (Min/Max)
2.5 or higher FYGPA								
ACTC	253	18	Lower	0.49 (0.44/0.53)	69 (53/90)	18 (0/81)	63 (48/90)	50 (0/99)
			Middle	0.52 (0.48/0.57)	70 (55/95)	10 (0/76)	70 (54/95)	37 (0/98)
			Higher	0.55 (0.5/0.61)	71 (55/97)	5 (0/67)	73 (57/97)	27 (0/98)
HSGPA		2.8	Lower	0.47 (0.39/0.54)	68 (51/90)	12 (-1/60)	63 (45/90)	36 (0/95)
			Middle	0.49 (0.34/0.55)	72 (55/95)	10 (0/52)	72 (54/95)	29 (0/90)
			Higher	0.53 (0.37/0.62)	74 (57/96)	6 (0/41)	77 (56/96)	24 (0/90)
ACTC & HSGPA			Lower	0.47 (0.09/0.59)	72 (51/90)	22 (0/79)	65 (49/91)	49 (0/99)
			Middle	0.50 (0.1/0.54)	74 (55/96)	14 (0/75)	73 (54/96)	36 (0/99)
			Higher	0.53 (0.08/0.59)	75 (56/97)	10 (0/66)	77 (55/97)	30 (0/98)

Table 8 (*continued)*

Predictor Variable	N	Total-group Cutoff	Income	Subgroup-specific probability of success Median (Min/Max)	Maximum Accuracy Rate (AR) Median (Min/Max)	Increase in AR (ΔAR) Median (Min/Max)	Success rate (SR) Median (Min/Max)	Observed percentage below OC (PB) Median (Min/Max)
3.0 or higher FYGPA								
ACTC	247	23	Lower	0.48 (0.43/0.53)	76 (60/92)	46 (0/83)	61 (41/86)	81 (0/100)
			Middle	0.52 (0.48/0.6)	74 (63/92)	33 (0/77)	67 (52/93)	71 (0/99)
			Higher	0.54 (0.5/0.65)	72 (61/96)	24 (0/68)	69 (54/96)	63 (0/97)
HSGPA		3.4	Lower	0.43 (0.35/0.59)	72 (53/89)	38 (0/70)	54 (39/90)	68 (2/99)
			Middle	0.49 (0.46/0.58)	74 (58/94)	29 (0/66)	65 (52/95)	58 (2/98)
			Higher	0.54 (0.47/0.64)	73 (58/97)	22 (0/61)	70 (56/97)	54 (1/97)
ACTC & HSGPA			Lower	0.45 (0.37/0.56)	77 (60/92)	47 (0/84)	61 (44/90)	76 (0/99)
			Middle	0.50 (0.44/0.55)	77 (62/93)	36 (0/78)	69 (51/95)	66 (0/99)
			Higher	0.53 (0.38/0.69)	76 (59/95)	28 (0/69)	72 (59/97)	60 (0/96)

Note: Multiple combinations of ACTC score and HSGPA correspond to a 0.50 probability of success for the joint models.

Table 8 shows the median validity statistics using ACTC score and HSGPA both independently and jointly to predict FYGPA success levels using the total-group cutoff values across income levels and institutions. At the 2.5 or higher FYGPA success level, as income level increased, typical ARs also increased slightly. For both success levels, as income increased, median ΔARs, as well as the observed percentage of students below the total-group cutoff, tended to decrease and median SRs increased. For the 3.0 or higher level, as income increased, typical ARs tended to decrease. Median ARs for lower- and middle-income students were higher for the 3.0 or higher level followed by the 2.5 or higher success level; median ARs were comparable between the two success levels. The typical SRs for each income level tended to decrease as the FYGPA success level increased. For both success levels the joint ACTC score and HSGPA model tended to produce slightly more favorable ARs and SRs, on average, across the income groups.

Conclusions

The race/ethnicity models show that for the ACTC score and HSGPA models the total-group model tends to underestimate FYGPA success for White students, while overestimating success for African American and Hispanic students. For both the ACTC score and HSGPA models at both success levels, White students have the highest estimated chances of success, typically followed by Hispanic students and then by African American students. For both success levels, differences in the estimated chances of success between the three race/ethnicity groups decrease as ACTC score increases. This is not true for the HSGPA models where the differences tend to persist.

In the HSGPA models, the chances of success for African American and Hispanic students are overestimated, particularly at higher levels. As a result, more students with a high HSGPA may be admitted to an institution and subsequently fail to attain higher levels of FYGPA.

Both the ACTC score and HSGPA total-group models underestimate the chances of success for females and overestimate them for males. Using a total-group cutoff to make admission decisions resulted in slightly greater prediction accuracy for females than for males at the 2.5 or higher success level, but the percentage of correct classifications were more comparable for females and males at the 3.0 or higher success level.

At the 2.5 or higher and 3.0 or higher levels, the joint model tends to produce greater prediction accuracy then when either ACTC score or HSGPA is used alone. Therefore, the use of a joint model which takes into consideration both ACTC score and HSGPA results in greater ability to accurately make admission decisions. Additionally, in the 2.5 or higher and 3.0 or higher success levels, the joint model tends to produce higher median ARs and SRs than when either predictor is used alone. At these levels the joint model tends to result in greater prediction accuracy than when either predictor is used alone.

When income is examined, in both the ACTC score and HSGPA models, the total-group model tends to underestimate the chances of success of higher-income students and overestimate the chances of lower-income students. For the HSGPA models, the estimates of success for middle-income students and the estimates from the total-group model do not differ substantially. For the ACTC score models, however, the total-group model tends to slightly underestimate the chances of success for middle-income students. Using the total-group cutoff at the 2.5 or higher level, as income increases, prediction accuracy increases in the ACTC score, HSGPA, and joint models. At the 3.0 or higher level, for the ACTC score, HSGPA, and joint models, as income increases, correct classifications remain similar while student success at meeting the FYGPA success level increases.

These findings are generally consistent with Sawyer (2013) who found that the joint use of ACTC score and HSGPA for making admission decisions, regardless of subgroup membership, resulted in greater incremental accuracy rates than when either predictor is used alone for a cutoff proportion of 0.50. Furthermore the current study found, as Sawyer (2013) did, that the joint usage of both predictors was moderately effective at increasing the incremental success rates than when either predictor was used alone.

The current study also provides evidence that the findings of Noble and Sawyer (2002) of using ACTC score and HSGPA jointly for making admission decisions resulted in greater prediction accuracy than using either predictor alone, regardless of subgroup membership, generally hold for racial/ethnic, gender, and income subgroups at the success levels of 2.5 or higher or 3.0 or higher FYGPA.

Implications

We examined the differential effect of using ACTC score, HSGPA, and both ACTC score and HSGPA jointly to predict FYGPA and make college admission decisions for student subgroups. The models developed provide insight into the use of the college readiness indicators of ACTC score and HSGPA to identify applicants who have a good chance of succeeding in college.

The results suggest that while subgroup differences exist, African American, Hispanic, and lower-income students are actually advantaged by the use of a total-group cutoff for making admission decisions. Additionally, it is worthwhile to note that the pattern of overprediction found for ACTC score is also seen for HSGPA. In fact, for income and race/ethnicity, as the success level increases, the differences in probability estimates between subgroups are larger for HSGPA than for ACTC score. Furthermore, the use of both ACTC score and HSGPA typically results in greater accuracy for predicting FYGPA success.

The current findings suggest that both ACTC score and HSGPA underpredict the probability of female success. Additionally the differences in probabilities between males and females, as well as between each subgroup and the total-group probability of success, are larger for ACTC score than for HSGPA. That said, however, when we examine the effects of using these predictors in isolation and in combination for admission decisions for males and females, the joint use of these predictors results in higher prediction accuracy at the success levels of 2.5 or higher and 3.0 or higher FYGPA.

Additionally, in comparing the estimated probability functions for ACTC score and HSGPA, we can see two important differences. First, it is apparent that the estimated probability function for HSGPA is shifted to the higher end of its scale. Practically speaking, this results in two not inconsequential concerns. While ACTC score produces actionable probability estimates over the entirety of its scale, students must score in the upper half of the HSGPA scale in order to produce probability estimates that allow greater applicant differentiation. For example in order for students to have a 50% chance of attaining a 2.5 or higher, or a 3.0 or higher, FYGPA a student would need to score a 17 or 22 ACTC score, respectively, or a 2.85 or 3.41 HSGPA, respectively.

Second, while the estimated probability of success at both success levels for students with an ACTC score of 36 (the ACTC ceiling score) approach 1.0, the probabilities for the HSGPA models do not. As a result students with higher HSGPAs are not estimated to have as high of a probability of success as when ACTC score is used. This finding is consistent with Sawyer (2013) who found that even for students with a high HSGPA the probability of a 3.0 or higher FYGPA depended on a student's ACTC score.

As Noble and Sawyer (2002) found previously, HSGPA is problematic as a predictor of high levels of FYGPA. The present research suggests that HSGPA may function better as a predictor of lower levels of FYGPA than of higher levels of FYGPA.

The differences in the predicted probability of success that we found among groups might be due to differences in variables not included in the prediction models. For example, students in different groups might differ in their courses taken, in their psychosocial characteristics (e.g., self-efficacy, academic discipline), or in situational variables (e.g., number of dependents, number of hours worked at a job).

These results do not support the claim that ACTC score adds little information to predicting college success outcomes. Instead, both ACTC score and HSGPA have an important role to play in helping college admission offices make informed admission decisions. Regardless of individual predictor performance, the present research supports using ACTC score and HSGPA jointly for measuring academic preparation and in making postsecondary admission decisions for all students.

References

ACT. (2004). *ACT Class Profile Service*. Iowa City, IA: Author.

ACT. (2005). *ACT Class Profile Service*. Iowa City, IA: Author.

ACT. (2006). *ACT Class Profile Service*. Iowa City, IA: Author.

ACT. (2007). *ACT Class Profile Service*. Iowa City, IA: Author.

American Educational Research Association. (1999). *Standards for educational and psychological testing.* Washington, DC: American Psychological Association.

Atkinson, R. C., & Geiser, S. (2011). Reflections on a Century of college admissions tests. In J. A. Soares (Ed.), *SAT Wars: the case for test-optional College Admissions* (pp. 23-49). New York, NY: Teachers College Press.

Bean, J. P. (1990) Strategic planning and enrollment management. In Hossler, D., & Bean, J. P. & Associates (Eds). *The strategic management of college enrollments* (pp.21-43). San Francisco, CA: Jossey-Bass.

Breland, H., Maxey, J., Gernand, R., Cumming, T., & Trapani, C. (2002). Trends in college admission admission 2000: A report of a survey of undergraduate admissions policies, practices, and procedures. Retrieved May 10, 2012 from the Association for Institutional Research website: http://www.airweb.org/images/trendsreport.pdf.

Breland, H. M., Maxey, J., McLure, G. T., Valiga, M. J., Boatwright, M. A., Ganley, V. L., & Jenkins, L. M. (1995). *Challenges in college admissions: A report of a survey of undergraduate admissions policies, practices, and procedures.* Washington, DC: American Association of Collegiate Registrars and Admissions Officers.

Clinedinst, M.E., Hurley, S.F., & Hawkins, D.A. (2011). *2011 State of College Admission.* Alexandria, VA: National Association for College Admissions Counseling.

College Board. (1997, June). *Common sense about the SAT score differences and test validity*. (RN-01). New York, NY: Author.

FairTest. (2007). *The ACT: Biased, Inaccurate, and Misused*. National Center for Fair and Open Testing. Retrieved April 16, 2012 from http://www.fairtest.org/act-biased-inaccurate-and-misused

González, J. (2012, April 22). Education for all? 2-year colleges struggle to preserve their mission. The Chronicle of Higher Education. Retrieved on May 10, 2012 from http://chronicle.com/article/2-Year-Colleges-Fight-to-Save/131608/

Hamilton College. (2012). *Application process: Standardized testing requirements*. Clinton, NY: Author. Retrieved April 16, 2012 from http://www.hamilton.edu/admission/apply/requirements

Mattern, K. D., Patterson, B. F., Shaw, E. J., Korbin, J. L., & Barbuti, S. M. (2008). D*ifferential Validity and prediction of the SAT* (College Board Research Rep. No. 2008-4). New York, NY: College Board.

Milewski, G. B., & Camara, W. J. (2002, September). *Colleges and Universities that do not require SAT or ACT scores* (College Board Research Notes, RN-18). New York, NY: College Board.

Moore, C., Shulock, N., & Offenstein, J. (2009). Steps to success: analyzing milestone achievement to improve community college student outcomes. Sacramento, CA: Institute for Higher Education Leadership & Policy.

Noble, J. (2003). *The Effects of Using ACT Composite Score and High School Average on College Admission Decisions for Racial/Ethnic Groups*. (ACT Research Report Series 2003-1). Iowa City, IA: ACT.

Noble, J., & Sawyer, R. (2002). *Predicting different levels of academic success in college using high school GPA and ACT Composite score*. (ACT Research Report Series 2002-4). Iowa City, IA: ACT.

Sarah Lawrence College. (2012). Frequently asked questions. Retrieved from http://www.slc.edu/undergraduate/admission/faq.html

Sawyer, R. (1985). *Using demographic information in predicting college freshman grades*. (ACT Research Report No. 87). Iowa City, IA: ACT.

Sawyer, R. L. (1996). *Decision theory models for validating course placement tests*. Journal of Educational Measurement, 33(3), 271-290.

Sawyer, R. (2013). *Beyond Correlations: Usefulness of high school average and ACT scores in making college admissions decisions*. Applied Measurement in Education 26(2), 89-112.

Wake Forest University. (2012). *The* a*pplication process.* Winston-Salem, NC: Author. Retrieved April 16, 2012 from http://admissions.wfu.edu/apply/sat.php

Young, J. W. (2001). *Differential Validity, Differential Prediction, and College Admissions Testing: A Comprehensive Review and Analysis*. (College Board Research Report 2001-6). New York, NY: The College Board.