Section 12. Test Characteristics

Provided in this section is a discussion of the results of analyses of test reliability, decision consistency, and decision accuracy for all test forms administered.

Reliability

The general concept of reliability concerns the precision of a test score. Of interest is quantifying the degree to which a score will vary from an average result obtained over many testing occasions due to random factors (Haertel, 2006). A variety of theories and methods can be used to estimate reliability. Classical test theory defines reliability as the proportion of total score variance that is true-score variance. Several different ways of estimating this proportion exist. The estimate of reliability given in this report is Cronbach's alpha (Cronbach, 1951), an internal consistency measure. It is derived from analysis of the consistency of performance over items within a test and provides a lower-bound estimate of a test's reliability. Cronbach's alpha can be expressed as:

$$\alpha = \frac{n}{n-1}\left[1 - \frac{\sum_{i=1}^{n}\sigma_i^2}{\sigma_x^2}\right],$$

where n is the number of items, σ_i^2 is the variance of scores on the i-th item, and σ_x^2 is the variance of the total score (sum of scores on the individual items).

Values for Cronbach's alpha were calculated for each test form, each test group, and selected subgroups, using the sample variances in place of the variances in the above expression. The results for the reliability analyses are presented along with other summary statistics in Tables 13.5 to 13.19 of Section 13. The tables show that the overall reliability coefficients for the MD Mod-HSA ranged from 0.56 to 0.82.

Decision Accuracy and Decision Consistency

The accuracy of decisions based on specified cut scores was assessed for reliability of classification using the ETS computer program *RELCLASS*, which provides two statistics that describe the reliability of classifications based on test scores (Livingston & Lewis, 1995). More specifically, information from an administration of one form is used to estimate the following:

> Decision accuracy describes the extent to which examinees are classified in the same way as they would be on the basis of the average of all possible forms of a test. Decision accuracy answers the question: How does the actual classification of test takers, based on their single-form scores, agree with the classification that would be made on the basis of their true scores, if their true scores were somehow known?

Decision consistency describes the extent to which examinees are classified in the same way they would be on the basis of a single form of a test other than the one for which data are available. Decision consistency answers the question: What is the agreement between the classifications based on two nonoverlapping, equally difficult forms of the test?

RELCLASS estimates decision accuracy using an estimated joint distribution of reported performance-level classifications on the current form of the test and the performance-level classifications based on an all-forms average (true score). *RELCLASS* estimates decision consistency using an estimated joint distribution of reported performance-level classifications on the current form of the test and performance-level classifications on an alternate (parallel) form. In each case, the proportion of performance-level classifications with exact agreement is the sum of the entries in the diagonal of the contingency table representing the joint distribution.

RELCLASS results were calculated using student scale scores derived from item-pattern score distributions for each form and content area. In a six cases, the *RELCLASS* program would not converge due to the nature of the data (i.e., small sample sizes, skewed scale score distributions). The six cases were January and April Biology, and four Summer populations, one for Algebra, two for Biology and one for English. The output provided in those tables was obtained by setting *RELCLASS* to override the convergence error and report results.

The results are provided in Tables 12.1 through 12.15 by content area for the October, January, April, May, and Summer administrations. The tables show decision accuracy values, which describe the agreement between classifications based on an observable variable (scores on one form of a test) and classifications based on an unobservable variable (the test takers' true scores). Decision accuracy values ranged from 0.71 to 0.90 across all performance levels and content areas and from 0.85 to 0.91 for the Proficient and Advanced classifications in Algebra, Biology, and English.

Decision consistency values describe the agreement between classifications based on two variables (scores on the form students have taken and a parallel form of the same test that is not administered to the students). Decision consistency values ranged from 0.61 to 0.86 across all performance levels and content areas and from 0.78 to 0.87 for the Proficient and Advanced classifications in Algebra, Biology, and English.

Note that in all cases the decision accuracy indices are somewhat larger than the decision consistency indices. This is due to differences in the estimation procedures. The estimation procedure for decision accuracy includes a random component on one of the two variables, whereas in estimating decision consistency each variable includes a random component (Livingston & Lewis, 1995).

Table 12.1 Decision Accuracy and Consistency: MD Mod-HSA Algebra October 2011

	Placement Scores	Advanced	Proficient	Basic	Category Total*
	450–650	.00	.00	.00	.00
Decision	412–449	.00	.03	.02	.06
Accuracy	240–411	.02	.06	.86	.94
	Estimated Proportion Correctly Classified*: Total = 0.90, Proficient & Above = 0.90				
	450–650	.00	.00	.00	.00
Decision	412–449	.01	.02	.03	.06
Consistency	240–411	.03	.08	.83	.94
	Estimated Proportion Consistently Classified*: Total = 0.85, Proficient & Above = 0.86				

*Inconsistencies between cell entries and totals are due to rounding.

Table 12.2 Decision Accuracy and Consistency: MD Mod-HSA Algebra January 2012

	Placement Scores	Advanced	Proficient	Basic	Category Total*
	450–650	.00	.00	.00	.00
Decision	412–449	.00	.04	.03	.08
Accuracy	240–411	.02	.06	.85	.92
	Estimated Proportion Correctly Classified: Total* = 0.89, Proficient & Above = 0.90				
	450–650	.00	.00	.00	.00
Decision	412–449	.01	.03	.03	.08
Consistency	240–411	.03	.08	.81	.92
	Estimated Proportion Consistently Classified*: Total = 0.85; Proficient & Above = 0.86				

* Inconsistencies between cell entries and totals are due to rounding.

Table 12.3 Decision Accuracy and Consistency: MD Mod-HSA Algebra April 2012

	Placement Scores	Advanced	Proficient	Basic	Category Total*
	450–650	.01	.00	.00	.01
Decision	412–449	.01	.05	.03	.10
Accuracy	240–411	.01	.05	.82	.89
	Estimated Proportion Correctly Classified*: Total = 0.89, Proficient & Above = 0.90				
	450–650	.01	.00	.00	.01
Decision	412–449	.02	.04	.04	.10
Consistency	240–411	.02	.08	.79	.89
	Estimated Proportion Consistently Classified*: Total = 0.84, Proficient & Above = 0.86				

*Inconsistencies between cell entries and totals are due to rounding.

Table 12.4 Decision Accuracy and Consistency: MD Mod-HSA Algebra May 2012

	Placement Scores	Advanced	Proficient	Basic	Category Total*
	450–650	.17	.08	.00	.25
Decision	412–449	.06	.24	.11	.40
Accuracy	240–411	.00	.05	.30	.35
	Estimated Proportion Correctly Classified*: Total = 0.71, Proficient & Above = 0.85				
	450–650	.16	.07	.01	.25
Decision	412–449	.10	.18	.13	.40
Consistency	240–411	.00	.07	.28	.35
	Estimated Proportion Consistently Classified*: Total = 0.62, Proficient & Above = 0.79				

* Inconsistencies between cell entries and totals are due to rounding.

Table 12.5 Decision Accuracy and Consistency: MD Mod-HSA Algebra Summer 2012

	Placement Scores	Advanced	Proficient	Basic	Category Total*
Summer Primary 1					
	450–650	.00	.00	.00	.00
Decision	412–449	.00	.01	.03	.03
Accuracy	240–411	.02	.07	.88	.97
	Estimated Proportion Correctly Classified*: Total = 0.88, Proficient & Above = 0.88				
	450–650	.00	.00	.00	.00
Decision	412–449	.01	.01	.02	.03
Consistency	240–411	.03	.08	.85	.97
	Estimated Proportion Consistently Classified*: Total = 0.86, Proficient & Above = 0.87				
Summer Primary 2					
	450–650	.00	.00	.00	.00
Decision	412–449	.03	.06	.03	.12
Accuracy	240–411	.02	.05	.82	.88
	Estimated Proportion Correctly Classified*: Total = 0.88, Proficient & Above = 0.91				
	450–650	.00	.00	.00	.00
Decision	412–449	.03	.04	.04	.12
Consistency	240–411	.02	.07	.80	.88
	Estimated Proportion Consistently Classified*: Total = 0.84, Proficient & Above = 0.87				

* Inconsistencies between cell entries and totals are due to rounding.

Table 12.6 Decision Accuracy and Consistency: MD Mod-HSA Biology October 2011

	Placement Scores	Advanced	Proficient	Basic	Category Total*
	452–650	.00	.00	.00	.00
Decision	400–451	.00	.05	.05	.10
Accuracy	240–399	.01	.07	.82	.90
	Estimated Proportion Consistently Classified*: Total = 0.87, Proficient & Above = 0.87				
	452–650	.00	.00	.00	.00
Decision	400–451	.00	.05	.05	.10
Consistency	240–399	.02	.11	.76	.90
	Estimated Proportion Consistently Classified*: Total = 0.81, Proficient & Above = 0.81				

* Inconsistencies between cell entries and totals are due to rounding.

Table 12.7 Decision Accuracy and Consistency: MD Mod-HSA Biology January 2012

	Placement Scores	Advanced	Proficient	Basic	Category Total*
	452–650	.00	.00	.00	.00
Decision	400–451	.00	.05	.05	.10
Accuracy	240–399	.01	.08	.81	.90
	Estimated Proportion Correctly Classified*: Total = 0.86, Proficient & Above = 0.86				
	452–650	.00	.00	.00	.00
Decision	400–451	.00	.05	.05	.10
Consistency	240–399	.02	.11	.76	.90
	Estimated Proportion Consistently Classified*: Total = 0.81, Proficient & Above = 0.81				

* Inconsistencies between cell entries and totals are due to rounding.

Table 12.8 Decision Accuracy and Consistency: MD Mod-HSA Biology April 2012

	Placement Scores	Advanced	Proficient	Basic	Category Total*
	452–650	.00	.00	.00	.00
Decision	400–451	.00	.04	.05	.09
Accuracy	240–399	.01	.08	.82	.91
	Estimated Proportion Correctly Classified*: Total = 0.86, Proficient & Above = 0.86				
	452–650	.00	.00	.00	.00
Decision	400–451	.00	.03	.06	.09
Consistency	240–399	.03	.12	.77	.91
	Estimated Proportion Consistently Classified*: Total = 0.80, Proficient & Above = 0.80				

*Inconsistencies between cell entries and totals are due to rounding.

Table 12.9 Decision Accuracy and Consistency: MD Mod-HSA Biology May 2012

	Placement Scores	Advanced	Proficient	Basic	Category Total*
	452–650	.15	.08	.00	.23
Decision	400–451	.06	.39	.08	.53
Accuracy	240–399	.00	.07	.18	.25
	Estimated Proportion Correctly Classified*: Total = 0.71, Proficient & Above = 0.85				
	452–650	.14	.09	.00	.23
Decision	400–451	.10	.30	.12	.53
Consistency	240–399	.00	.08	.17	.25
	Estimated Proportion Consistently Classified*: Total = 0.61, Proficient & Above = 0.80				

* Inconsistencies between cell entries and totals are due to rounding.

Table 12.10 Decision Accuracy and Consistency: MD Mod-HSA Biology 2012 Summer

	Placement Scores	Advanced	Proficient	Basic	Category Total*
Summer Primary 1					
	452–650	.00	.00	.00	.00
Decision	400–451	.01	.09	.06	.16
Accuracy	240–399	.01	.06	.78	.84
	Estimated Proportion Correctly Classified*: Total = 0.86, Proficient & Above = 0.88				
	452–650	.00	.00	.00	.00
Decision	400–451	.02	.07	.06	.16
Consistency	240–399	.02	.09	.74	.84
	Estimated Proportion Consistently Classified*: Total = 0.81, Proficient & Above = 0.83				
Summer Primary 2					
	452–650	.00	.00	.00	.00
Decision	400–451	.00	.05	.07	.12
Accuracy	240–399	.00	.09	.79	.88
	Estimated Proportion Correctly Classified*: Total = 0.84, Proficient & Above = 0.84				
	452–650	.00	.00	.00	.00
Decision	400–451	.00	.06	.06	.12
Consistency	240–399	.01	.14	.73	.88
	Estimated Proportion Consistently Classified*: Total = 0.78, Proficient & Above = 0.78				

* Inconsistencies between cell entries and totals are due to rounding.

Table 12.11 Decision Accuracy and Consistency: MD Mod-HSA English October 2011

	Placement Scores	Advanced	Proficient	Basic	Category Total*
Decision Accuracy	429–650	.01	.00	.00	.01
	396–428	.01	.07	.04	.12
	240–395	.02	.06	.80	.87
	Estimated Proportion Correctly Classified*: Total = 0.87, Proficient & Above = 0.89				
Decision Consistency	429–650	.01	.00	.00	.01
	396–428	.02	.05	.04	.12
	240–395	.02	.08	.77	.87
	Estimated Proportion Consistently Classified*: Total = 0.82, Proficient & Above = 0.85				

* Inconsistencies between cell entries and totals are due to rounding.

Table 12.12 Decision Accuracy and Consistency: MD Mod-HSA English January 2012

	Placement Scores	Advanced	Proficient	Basic	Category Total*
Decision Accuracy	429–650	.00	.00	.00	.00
	396–428	.02	.07	.04	.13
	240–395	.01	.06	.80	.87
	Estimated Proportion Correctly Classified*: Total = 0.87, Proficient & Above = 0.89				
Decision Consistency	429–650	.00	.00	.00	.01
	396–428	.03	.06	.05	.13
	240–395	.02	.08	.77	.87
	Estimated Proportion Consistently Classified*: Total = 0.82, Proficient & Above = 0.85				

* Inconsistencies between cell entries and totals are due to rounding

Table 12.13 Decision Accuracy and Consistency: MD Mod-HSA English April 2012

	Placement Scores	Advanced	Proficient	Basic	Category Total*
Decision Accuracy	429–650	.01	.00	.00	.01
	396–428	.02	.08	.05	.15
	240–395	.01	.05	.77	.84
	Estimated Proportion Correctly Classified*: Total = 0.87, Proficient & Above = 0.89				
Decision Consistency	429–650	.01	.00	.00	.01
	396–428	.03	.07	.05	.15
	240–395	.02	.08	.74	.84
	Estimated Proportion Consistently Classified*: Total = 0.82, Proficient & Above = 0.85				

*Inconsistencies between cell entries and totals are due to rounding.

Table 12.14 Decision Accuracy and Consistency: MD Mod-HSA English May 2012

	Placement Scores	Advanced	Proficient	Basic	Category Total*
Decision Accuracy	429–650	.19	.08	.00	.27
	396–428	.06	.30	.08	.44
	240–395	.00	.06	.24	.30
	Estimated Proportion Correctly Classified*: Total = 0.72, Proficient & Above = 0.86				
Decision Consistency	429–650	.18	.08	.01	.27
	396–428	.09	.23	.11	.44
	240–395	.00	.07	.22	.30
	Estimated Proportion Consistently Classified*: Total = 0.63, Proficient & Above = 0.81				

* Inconsistencies between cell entries and totals are due to rounding.

Table 12.15 Decision Accuracy and Consistency: MD Mod-HSA English Summer 2012

	Placement Scores	Advanced	Proficient	Basic	Category Total*
Summer Form 5					
Decision Accuracy	429–650	.00	.01	.00	.01
	396–428	.00	.04	.03	.06
	240–395	.01	.06	.85	.92
	Estimated Proportion Correctly Classified*: Total = 0.89, Proficient & Above = 0.90				
Decision Consistency	429–650	.01	.00	.00	.01
	396–428	.00	.03	.03	.06
	240–395	.02	.09	.81	.92
	Estimated Proportion Consistently Classified*: Total = 0.85, Proficient & Above = 0.85				
Summer Form 6					
Decision Accuracy	429–650	.00	.00	.00	.00
	396–428	.03	.08	.05	.16
	240–395	.01	.05	.78	.84
	Estimated Proportion Correctly Classified*: Total = 0.87, Proficient & Above = 0.89				
Decision Consistency	429–650	.00	.00	.00	.00
	396–428	.04	.07	.06	.16
	240–395	.02	.07	.75	.84
	Estimated Proportion Consistently Classified*: Total = 0.82, Proficient & Above* = 0.86				

* Inconsistencies between cell entries and totals are due to rounding.