

## Section 5. Test Characteristics

This section provides a discussion of the results of analyses of test reliability and decision consistency and accuracy for all MD HSA 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. One estimate of reliability that is commonly used is Cronbach's (1951) alpha, 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,  $\sigma_i^2$  is the variance of scores on the  $i$ -th item, and  $\sigma_x^2$  is the variance of the total score (sum of scores on the individual items). Sample estimates are substituted for the population variances in this formula to provide reliability estimates.

The results for the reliability analyses of the total test score are presented with the summary statistics in Tables 6.5 to 6.19. The tables show that the overall reliability of the MD HSAs administered during the January and May sessions ranged from 0.83 to 0.94 for the primary forms, and from 0.81 to 0.94 for the makeup forms. The overall reliability results for the October forms ranged from 0.75 to 0.79. The overall reliability results for the April forms ranged from 0.77 to 0.76. The overall reliability results for the Summer forms ranged from 0.82 to 0.87.

Lower reliability coefficients are sometimes seen for the smaller administrations typically taken by repeat test-takers (October, April, and Summer). All forms are constructed to meet the same target specifications, one of which is to include only items that have point-biserials of at least 0.10. However, when items are administered to nonrepresentative samples of students, the point-biserials of some items may be somewhat lower in those samples, which leads to lower reliability coefficients when calculated for those administrations.

## Decision Accuracy and Decision Consistency

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

Decision accuracy, or 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, or the extent to which examinees are classified in the same way as 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 exam 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 exam and performance-level classifications on the 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.

The results are provided in Tables 5.1 to 5.15 by content area for the October, January, April, May, and Summer forms. The tables show that 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), ranged from 0.80 to 0.88 across all performance levels and from 0.86 to 0.94 for the Proficient and Above classifications in Algebra, Biology, and English. Decision consistency values, which 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), ranged from 0.74 to 0.86 across all performance levels and from 0.74 to 0.92 for the Proficient and Above 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 5.1 Decision Accuracy and Consistency: MD HSA Algebra October 2011 Form

	Placement Scores	Advanced	Proficient	Basic	Category Total*
Decision Accuracy	450–650	.01	.00	.00	.01
	412–449	.01	.11	.06	.18
	240–411	.01	.07	.73	.81
Estimated Proportion Correctly Classified*: Total = 0.85 , Proficient & Above = 0.86					
Decision Consistency	450–650	.01	.00	.00	.01
	412–449	.03	.09	.07	.18
	240–411	.02	.10	.69	.81
Estimated Proportion Consistently Classified*: Total = 0.79 , Proficient & Above = 0.81					

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

Table 5.2 Decision Accuracy and Consistency: MD HSA Algebra January 2012 Forms

	Placement Scores	Advanced	Proficient	Basic	Category Total*
January Primary					
Decision Accuracy	450–650	.02	.00	.00	.02
	412–449	.03	.13	.05	.21
	240–411	.01	.06	.70	.77
Estimated Proportion Correctly Classified: Total*: = 0.85, Proficient & Above = 0.87					
Decision Consistency	450–650	.02	.00	.00	.02
	412–449	.04	.11	.06	.21
	240–411	.02	.09	.67	.77
Estimated Proportion Consistently Classified*: Total = 0.79 ; Proficient & Above = 0.83					
January Form C					
Decision Accuracy	450–650	.02	.00	.00	.02
	412–449	.02	.15	.06	.23
	240–411	.01	.06	.68	.75
Estimated Proportion Correctly Classified*: Total = 0.85 ; Proficient & Above = 0.87					
Decision Consistency	450–650	.02	.00	.00	.02
	412–449	.04	.12	.07	.23
	240–411	.01	.09	.65	.75
Estimated Proportion Consistently Classified*: Total = 0.79, Proficient & Above = 0.83					

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

Table 5.3 Decision Accuracy and Consistency: MD HSA Algebra April 2012 Form

	Placement Scores	Advanced	Proficient	Basic	Category Total*
Decision Accuracy	450–650	.01	.00	.00	.01
	412–449	.00	.07	.04	.12
	240–411	.01	.06	.80	.87
Estimated Proportion Correctly Classified*: Total = 0.88, Proficient & Above = 0.89					
Decision Consistency	450–650	.01	.00	.00	.01
	412–449	.01	.06	.04	.12
	240–411	.02	.09	.77	.87
Estimated Proportion Consistently Classified*: Total = 0.83, Proficient & Above = 0.85					

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

Table 5.4 Decision Accuracy and Consistency: MD HSA Algebra May 2012 Forms

	Placement Scores	Advanced	Proficient	Basic	Category Total*
<b>May Primary</b>					
Decision Accuracy	450–650	.20	.05	.00	.25
	412–449	.04	.28	.08	.40
	240–411	.00	.01	.34	.35
Estimated Proportion Correctly Classified*: Total = 0.83 , Proficient & Above = 0.91					
Decision Consistency	450–650	.19	.05	.00	.25
	412–449	.06	.24	.10	.40
	240–411	.00	.02	.33	.35
Estimated Proportion Consistently Classified*: Total = 0.76 , Proficient & Above = 0.88					
<b>May Form X</b>					
Decision Accuracy	450–650	.14	.03	.00	.17
	412–449	.04	.22	.08	.34
	240–411	.00	.02	.47	.49
Estimated Proportion Correctly Classified*: Total = 0.83, Proficient & Above = 0.90					
Decision Consistency	450–650	.13	.04	.00	.17
	412–449	.06	.19	.09	.34
	240–411	.00	.04	.45	.49
Estimated Proportion Consistently Classified*: Total = 0.77, Proficient & Above = 0.87					
<b>May Form Y</b>					
Decision Accuracy	450–650	.19	.05	.00	.24
	412–449	.04	.28	.08	.39
	240–411	.00	.01	.36	.37
Estimated Proportion Correctly Classified*: Total = 0.82, Proficient & Above = 0.91					
Decision Consistency	450–650	.18	.06	.00	.24
	412–449	.06	.24	.09	.39
	240–411	.00	.03	.34	.37
Estimated Proportion Consistently Classified*: Total = 0.76, Proficient & Above = 0.87					

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

Table 5.5 Decision Accuracy and Consistency: MD HSA Algebra Summer 2012 Forms

	Placement Scores	Advanced	Proficient	Basic	Category Total*
<b>Summer Form P</b>					
	450–650	.01	.00	.00	.01
Decision	412–449	.05	.16	.07	.28
Accuracy	240–411	.00	.04	.67	.71
Estimated Proportion Correctly Classified*: Total = 0.83, Proficient & Above = 0.88					
	450–650	.01	.00	.00	.01
Decision	412–449	.06	.13	.09	.28
Consistency	240–411	.01	.07	.64	.71
Estimated Proportion Consistently Classified*: Total = 0.78, Proficient & Above = 0.84					
<b>Summer Form Q</b>					
	450–650	.03	.00	.00	.04
Decision	412–449	.03	.18	.06	.26
Accuracy	240–411	.00	.05	.65	.70
Estimated Proportion Correctly Classified*: Total = 0.86, Proficient & Above = 0.89					
	450–650	.03	.01	.00	.04
Decision	412–449	.04	.15	.07	.26
Consistency	240–411	.00	.07	.62	.70
Estimated Proportion Consistently Classified*: Total = 0.81, Proficient & Above = 0.85					

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

Table 5.6 Decision Accuracy and Consistency: MD HSA Biology October 2011 Form

	Placement Scores	Advanced	Proficient	Basic	Category Total*
	452–650	.00	.01	.00	.01
Decision	400–451	.00	.12	.05	.16
Accuracy	240–399	.01	.07	.75	.83
Estimated Proportion Consistently Classified*: Total = 0.87, Proficient & Above = 0.88					
	452–650	.00	.00	.00	.01
Decision	400–451	.00	.11	.06	.16
Consistency	240–399	.01	.11	.71	.83
Estimated Proportion Consistently Classified*: Total = 0.82, Proficient & Above = 0.83					

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

Table 5.7 Decision Accuracy and Consistency: MD HSA Biology January 2012 Forms

	Placement Scores	Advanced	Proficient	Basic	Category Total*
<b>January Primary</b>					
	452–650	.07	.04	.00	.12
Decision	400–451	.00	.31	.00	.31
Accuracy	240–399	.02	.07	.48	.57
Estimated Proportion Correctly Classified*: Total = 0.86, Proficient & Above = 0.91					
	452–650	.06	.05	.00	.12
Decision	400–451	.02	.27	.02	.31
Consistency	240–399	.02	.08	.47	.57
Estimated Proportion Consistently Classified*: Total = 0.80, Proficient & Above = 0.88					
<b>January Form C</b>					
	452–650	.03	.08	.00	.11
Decision	400–451	.00	.33	.00	.33
Accuracy	240–399	.02	.09	.45	.56
Estimated Proportion Correctly Classified*: Total = 0.82, Proficient & Above = 0.89					
	452–650	.04	.06	.01	.11
Decision	400–451	.01	.31	.00	.33
Consistency	240–399	.03	.09	.45	.56
Estimated Proportion Consistently Classified*: Total = 0.80, Proficient & Above = 0.88					

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

Table 5.8 Decision Accuracy and Consistency: MD HSA Biology April 2012 Form

	Placement Scores	Advanced	Proficient	Basic	Category Total*
	452–650	.00	.00	.00	.00
Decision	400–451	.00	.10	.04	.14
Accuracy	240–399	.01	.06	.79	.85
Estimated Proportion Correctly Classified*: Total = 0.88, Proficient & Above = 0.89					
	452–650	.00	.00	.00	.00
Decision	400–451	.00	.09	.05	.14
Consistency	240–399	.01	.10	.75	.85
Estimated Proportion Consistently Classified*: Total = 0.84, Proficient & Above = 0.84					

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

Table 5.9 Decision Accuracy and Consistency: MD HSA Biology May 2012 Forms

	Placement Scores	Advanced	Proficient	Basic	Category Total*
<b>May Primary</b>					
	452–650	.21	.02	.00	.23
Decision	400–451	.07	.42	.03	.53
Accuracy	240–399	.00	.03	.22	.25
Estimated Proportion Correctly Classified*: Total = 0.85, Proficient & Above = 0.94					
	452–650	.19	.04	.00	.23
Decision	400–451	.09	.39	.04	.53
Consistency	240–399	.00	.03	.21	.25
Estimated Proportion Consistently Classified*: Total = 0.79, Proficient & Above = 0.92					
<b>May Form X</b>					
	452–650	.16	.03	.00	.19
Decision	400–451	.04	.40	.06	.49
Accuracy	240–399	.00	.01	.30	.31
Estimated Proportion Correctly Classified*: Total = 0.86, Proficient & Above = 0.93					
	452–650	.16	.04	.00	.19
Decision	400–451	.05	.37	.08	.49
Consistency	240–399	.00	.03	.29	.31
Estimated Proportion Consistently Classified*: Total = 0.81, Proficient & Above = 0.90					
<b>May Form Y</b>					
	452–650	.22	.02	.00	.24
Decision	400–451	.06	.42	.04	.52
Accuracy	240–399	.00	.03	.22	.25
Estimated Proportion Correctly Classified*: Total = 0.87, Proficient & Above = 0.94					
	452–650	.21	.03	.00	.24
Decision	400–451	.07	.39	.05	.52
Consistency	240–399	.00	.03	.21	.25
Estimated Proportion Consistently Classified*: Total = 0.81, Proficient & Above = 0.92					

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

Table 5.10 Decision Accuracy and Consistency: MD HSA Biology Summer 2012 Forms

	Placement Scores	Advanced	Proficient	Basic	Category Total*
<b>Summer Form P</b>					
	452–650	.01	.00	.00	.02
Decision	400–451	.01	.16	.05	.22
Accuracy	240–399	.01	.06	.70	.76
Estimated Proportion Correctly Classified*: Total = 0.87, Proficient & Above = 0.88					
	452–650	.01	.00	.00	.02
Decision	400–451	.02	.13	.06	.22
Consistency	240–399	.01	.09	.67	.76
Estimated Proportion Consistently Classified*: Total = 0.82, Proficient & Above = 0.84					
<b>Summer Form Q</b>					
	452–650	.01	.00	.00	.01
Decision	400–451	.01	.21	.06	.28
Accuracy	240–399	.00	.05	.65	.71
Estimated Proportion Correctly Classified*: Total = 0.87, Proficient & Above = 0.89					
	452–650	.01	.00	.00	.01
Decision	400–451	.02	.18	.08	.28
Consistency	240–399	.00	.08	.62	.71
Estimated Proportion Consistently Classified*: Total = 0.82, Proficient & Above = 0.84					

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

Table 5.11 Decision Accuracy and Consistency: MD HSA English October 2010 Form

	Placement Scores	Advanced	Proficient	Basic	Category Total*
	429–650	.01	.00	.00	.01
Decision	396–428	.01	.12	.05	.18
Accuracy	240–395	.01	.06	.74	.81
Estimated Proportion Correctly Classified*: Total = 0.87, Proficient & Above = 0.88					
	429–650	.01	.00	.00	.01
Decision	396–428	.02	.10	.06	.18
Consistency	240–395	.01	.09	.71	.81
Estimated Proportion Consistently Classified*: Total = 0.81, Proficient & Above = 0.83					

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



Table 5.12 Decision Accuracy and Consistency: MD HSA English January 2012 Forms

	Placement Scores	Advanced	Proficient	Basic	Category Total*
<b>January Primary</b>					
	429–650	.09	.02	.00	.10
Decision	396–428	.03	.21	.05	.29
Accuracy	240–395	.00	.06	.55	.61
Estimated Proportion Correctly Classified*: Total = 0.85, Proficient & Above = 0.89					
	429–650	.08	.02	.00	.10
Decision	396–428	.04	.18	.06	.29
Consistency	240–395	.01	.08	.53	.61
Estimated Proportion Consistently Classified*: Total = 0.79, Proficient & Above = 0.85					
<b>January Form C</b>					
	429–650	.00	.08	.01	.09
Decision	396–428	.00	.30	.00	.30
Accuracy	240–395	.00	.11	.51	.61
Estimated Proportion Correctly Classified*: Total = 0.80, Proficient & Above = 0.88					
	429–650	.03	.05	.01	.09
Decision	396–428	.02	.23	.04	.30
Consistency	240–395	.02	.11	.48	.61
Estimated Proportion Consistently Classified*: Total = 0.74, Proficient & Above = 0.82					

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

Table 5.13 Decision Accuracy and Consistency: MD HSA English April 2012 Form

	Placement Scores	Advanced	Proficient	Basic	Category Total*
	429–650	.01	.00	.00	.01
Decision	396–428	.01	.06	.03	.12
Accuracy	240–395	.02	.06	.81	.89
Estimated Proportion Correctly Classified*: Total = 0.87, Proficient & Above = 0.88					
	429–650	.01	.00	.00	.01
Decision	396–428	.02	.05	.04	.11
Consistency	240–395	.03	.09	.77	.89
Estimated Proportion Consistently Classified*: Total = 0.82, Proficient & Above = 0.84					

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

Table 5.14 Decision Accuracy and Consistency: MD HSA English May 2012 Forms

	Placement Scores	Advanced	Proficient	Basic	Category Total*
<b>May Primary</b>					
	429–650	.22	.05	.00	.27
Decision	396–428	.04	.33	.06	.44
Accuracy	240–395	.00	.02	.27	.30
Estimated Proportion Correctly Classified*: Total = 0.82, Proficient & Above = 0.91					
	429–650	.21	.06	.00	.27
Decision	396–428	.06	.29	.08	.44
Consistency	240–395	.00	.04	.26	.30
Estimated Proportion Consistently Classified*: Total = 0.76, Proficient & Above = 0.88					
<b>May Form X</b>					
	429–650	.19	.04	.00	.22
Decision	396–428	.04	.27	.07	.39
Accuracy	240–395	.00	.02	.37	.39
Estimated Proportion Correctly Classified*: Total = 0.83, Proficient & Above = 0.91					
	429–650	.18	.04	.00	.22
Decision	396–428	.06	.23	.09	.39
Consistency	240–395	.00	.04	.36	.39
Estimated Proportion Consistently Classified*: Total = 0.77, Proficient & Above = 0.88					
<b>May Form Y</b>					
	429–650	.22	.05	.00	.27
Decision	396–428	.04	.31	.06	.42
Accuracy	240–395	.00	.02	.29	.31
Estimated Proportion Correctly Classified*: Total = 0.82, Proficient & Above = 0.91					
	429–650	.21	.06	.00	.27
Decision	396–428	.06	.27	.08	.42
Consistency	240–395	.00	.04	.27	.31
Estimated Proportion Consistently Classified*: Total = 0.75, Proficient & Above = 0.87					

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

Table 5.15 Decision Accuracy and Consistency: MD HSA English Summer 2012 Forms

	Placement Scores	Advanced	Proficient	Basic	Category Total*
<b>Summer Form P</b>					
	429–650	.01	.00	.00	.01
Decision	396–428	.03	.15	.06	.24
Accuracy	240–395	.01	.06	.68	.75
Estimated Proportion Correctly Classified*: Total = 0.84, Proficient & Above = 0.87					
	429–650	.01	.00	.00	.01
Decision	396–428	.05	.12	.07	.24
Consistency	240–395	.01	.09	.65	.75
Estimated Proportion Consistently Classified*: Total = 0.78, Proficient & Above = 0.83					
<b>Summer Form Q</b>					
	429–650	.02	.00	.00	.02
Decision	396–428	.02	.16	.06	.24
Accuracy	240–395	.00	.05	.68	.74
Estimated Proportion Correctly Classified*: Total = 0.86, Proficient & Above = 0.88					
	429–650	.02	.00	.00	.02
Decision	396–428	.03	.13	.07	.24
Consistency	240–395	.01	.08	.65	.74
Estimated Proportion Consistently Classified*: Total = 0.80, Proficient & Above* = 0.84					

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