

Section 12. Test Characteristics

Provided in this section is a discussion of the results of analyses of test reliability and 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. The results for the reliability analyses are presented along with other summary statistics in Tables 13.5 to 13.24 of Section 13. The tables show that the overall reliability coefficients for the MD Mod-HSA ranged from 0.63 to 0.86.

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 non-overlapping, 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 three cases, the *RELCLASS* program would not converge due to the nature of the data (i.e., small sample sizes). The three cases were Biology Form 409, English Form 409, and Government Form 409, all taken by the Summer populations.

The results are provided in Tables 12.1 to 12.20 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 0.83 to 0.90 across all performance levels and content areas and from 0.86 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 0.79 to 0.87 across all performance levels and content areas and from 0.81 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 2008 Form

Form 108	Placement Scores	Estimated Proportion Within Category			
		Advanced	Proficient	Basic	Category Total
	450–650	0.00	0.00	0.00	0.00
Decision Accuracy	412–449	0.00	0.05	0.03	0.08
	240–411	0.02	0.06	0.84	0.92
Estimated Proportion Correctly Classified* = 0.89 ; Proficient & Above = 0.89					
	450–650	0.00	0.00	0.00	0.00
Decision Consistency	412–449	0.01	0.03	0.03	0.08
	240–411	0.03	0.09	0.80	0.92
Estimated Proportion Consistently Classified* = 0.84 ; Proficient & Above = 0.85					

*Inconsistencies within category cell entries are due to rounding.

Table 12.2 Decision Accuracy and Consistency: MD Mod-HSA Algebra January 2009 Form

Form 209	Placement Scores	Estimated Proportion Within Category			
		Advanced	Proficient	Basic	Category Total
	450–650	0.00	0.00	0.00	0.00
Decision Accuracy	412–449	0.00	0.04	0.03	0.07
	240–411	0.02	0.06	0.86	0.93
Estimated Proportion Correctly Classified* = 0.90 ; Proficient & Above = 0.90					
	450–650	0.00	0.00	0.00	0.00
Decision Consistency	412–449	0.01	0.03	0.03	0.07
	240–411	0.02	0.08	0.82	0.93
Estimated Proportion Consistently Classified* = 0.85 ; Proficient & Above = 0.86					

*Inconsistencies within category cell entries are due to rounding.

Table 12.3 Decision Accuracy and Consistency: MD Mod-HSA Algebra April 2009 Form

Form 209	Placement Scores	Estimated Proportion Within Category			
		Advanced	Proficient	Basic	Category Total
	450–650	0.00	0.00	0.00	0.00
Decision Accuracy	412–449	0.00	0.04	0.02	0.07
	240–411	0.02	0.06	0.85	0.93
Estimated Proportion Correctly Classified* = 0.90 ; Proficient & Above = 0.90					
	450–650	0.00	0.00	0.00	0.00
Decision Consistency	412–449	0.01	0.03	0.03	0.07
	240–411	0.03	0.09	0.81	0.93
Estimated Proportion Consistently Classified* = 0.85 ; Proficient & Above = 0.86					

*Inconsistencies within category cell entries are due to rounding.

Table 12.4 Decision Accuracy and Consistency: MD Mod-HSA Algebra May 2009 Form

Form 109	Placement Scores	Estimated Proportion Within Category			Category Total
		Advanced	Proficient	Basic	
	450–650	0.00	0.00	0.00	0.00
Decision Accuracy	412–449	0.02	0.06	0.04	0.11
	240–411	0.02	0.05	0.82	0.89
Estimated Proportion Correctly Classified* = 0.88 ; Proficient & Above = 0.90					
	450–650	0.00	0.00	0.00	0.00
Decision Consistency	412–449	0.03	0.04	0.04	0.11
	240–411	0.02	0.07	0.79	0.89
Estimated Proportion Consistently Classified* = 0.83 ; Proficient & Above = 0.86					

*Inconsistencies within category cell entries are due to rounding.

Table 12.5 Decision Accuracy and Consistency: MD Mod-HSA Algebra Summer 2009 Form

Form 309	Placement Scores	Estimated Proportion Within Category			Category Total
		Advanced	Proficient	Basic	
	450–650	0.01	0.00	0.00	0.01
Decision Accuracy	412–449	0.00	0.03	0.02	0.05
	240–411	0.02	0.06	0.87	0.94
Estimated Proportion Correctly Classified* = 0.90 ; Proficient & Above = 0.91					
	450–650	0.01	0.00	0.00	0.01
Decision Consistency	412–449	0.00	0.02	0.02	0.05
	240–411	0.03	0.08	0.83	0.94
Estimated Proportion Consistently Classified* = 0.87 ; Proficient & Above = 0.87					
Form 409					
	450–650	0.00	0.00	0.00	0.00
Decision Accuracy	412–449	0.06	0.09	0.05	0.19
	240–411	0.02	0.04	0.75	0.81
Estimated Proportion Correctly Classified* = 0.83 ; Proficient & Above = 0.89					
	450–650	0.00	0.00	0.00	0.00
Decision Consistency	412–449	0.07	0.07	0.06	0.19
	240–411	0.03	0.06	0.72	0.81
Estimated Proportion Consistently Classified* = 0.79 ; Proficient & Above = 0.86					

*Inconsistencies within category cell entries are due to rounding.

Table 12.6 Decision Accuracy and Consistency: MD Mod-HSA Biology October 2008 Form

Form 108	Placement Scores	Estimated Proportion Within Category			Category Total
		Advanced	Proficient	Basic	
	452–650	0.00	0.00	0.00	0.00
Decision Accuracy	400–451	0.00	0.08	0.06	0.13
	240–399	0.01	0.07	0.79	0.87
Estimated Proportion Correctly Classified* = 0.86 ; Proficient & Above = 0.86					
	452–650	0.00	0.00	0.00	0.00
Decision Consistency	400–451	0.01	0.06	0.06	0.13
	240–399	0.02	0.11	0.74	0.87
Estimated Proportion Consistently Classified* = 0.80 ; Proficient & Above = 0.81					

*Inconsistencies within category cell entries are due to rounding.

Table 12.7 Decision Accuracy and Consistency: MD Mod-HSA Biology January 2009 Form

Form 209	Placement Scores	Estimated Proportion Within Category			Category Total
		Advanced	Proficient	Basic	
	452–650	0.00	0.00	0.00	0.00
Decision Accuracy	400–451	0.00	0.08	0.05	0.12
	240–399	0.01	0.07	0.79	0.87
Estimated Proportion Correctly Classified* = 0.86 ; Proficient & Above = 0.87					
	452–650	0.00	0.00	0.00	0.00
Decision Consistency	400–451	0.01	0.07	0.05	0.12
	240–399	0.02	0.11	0.74	0.87
Estimated Proportion Consistently Classified* = 0.81 ; Proficient & Above = 0.81					

*Inconsistencies within category cell entries are due to rounding.

Table 12.8 Decision Accuracy and Consistency: MD Mod-HSA Biology April 2009 Form

Form 209	Placement Scores	Estimated Proportion Within Category			Category Total
		Advanced	Proficient	Basic	
	452–650	0.00	0.01	0.00	0.01
Decision Accuracy	400–451	0.00	0.07	0.04	0.11
	240–399	0.01	0.07	0.80	0.88
Estimated Proportion Correctly Classified* = 0.87 ; Proficient & Above = 0.87					
	452–650	0.00	0.00	0.00	0.01
Decision Consistency	400–451	0.00	0.06	0.05	0.11
	240–399	0.02	0.11	0.75	0.88
Estimated Proportion Consistently Classified* = 0.82 ; Proficient & Above = 0.82					

*Inconsistencies within category cell entries are due to rounding.

Table 12.9 Decision Accuracy and Consistency: MD Mod-HSA Biology May 2009 Form

Form 109	Placement Scores	Estimated Proportion Within Category			Category Total
		Advanced	Proficient	Basic	
	452–650	0.00	0.00	0.00	0.00
Decision Accuracy	400–451	0.00	0.10	0.06	0.16
	240–399	0.01	0.07	0.76	0.84
Estimated Proportion Correctly Classified* = 0.86 ; Proficient & Above = 0.86					
	452–650	0.00	0.00	0.00	0.00
Decision Consistency	400–451	0.01	0.08	0.07	0.16
	240–399	0.02	0.11	0.72	0.84
Estimated Proportion Correctly Classified* = 0.80 ; Proficient & Above = 0.81					

*Inconsistencies within category cell entries are due to rounding.

Table 12.10 Decision Accuracy and Consistency: MD Mod-HSA Biology 2009 Summer Form

Form 309	Placement Scores	Estimated Proportion Within Category			Category Total
		Advanced	Proficient	Basic	
	452–650	0.00	0.00	0.00	0.00
Decision Accuracy	400–451	0.00	0.08	0.03	0.11
	240–399	0.02	0.07	0.80	0.89
Estimated Proportion Correctly Classified* = 0.88 ; Proficient & Above = 0.88					
	452–650	0.00	0.00	0.00	0.00
Decision Consistency	400–451	0.01	0.06	0.04	0.11
	240–399	0.02	0.11	0.76	0.89
Estimated Proportion Consistently Classified* = 0.82 ; Proficient & Above = 0.83					
Form 409					
	452–650	-	-	-	-
Decision Accuracy	400–451	-	-	-	-
	240–399	-	-	-	-
Insufficient sample size < 50					
	452–650	-	-	-	-
Decision Consistency	400–451	-	-	-	-
	240–399	-	-	-	-
Insufficient sample size < 50					

*Inconsistencies within category cell entries are due to rounding.

Table 12.11 Decision Accuracy and Consistency: MD Mod-HSA English October 2008 Form

Form 108	Placement	Advanced	Proficient	Basic	Category
	Scores				Total*
	429–650	0.00	0.00	0.00	0.00
Decision	396–428	0.02	0.07	0.04	0.12
Accuracy	240–395	0.02	0.06	0.79	0.87
Estimated Proportion Correctly Classified*: Total = 0.87, Proficient & Above = 0.88					
	429–650	0.00	0.00	0.00	0.00
Decision	396–428	0.03	0.05	0.05	0.12
Consistency	240–395	0.03	0.09	0.76	0.87
Estimated Proportion Consistently Classified*: Total = 0.81; Proficient & Above = 0.84					

*Inconsistencies within category cell entries are due to rounding.

Table 12.12 Decision Accuracy and Consistency: MD Mod-HSA English January 2009 Form

Form 209	Placement	Advanced	Proficient	Basic	Category
	Scores				Total*
	429–650	0.00	0.00	0.00	0.00
Decision	396–428	0.01	0.07	0.04	0.12
Accuracy	240–395	0.01	0.06	0.80	0.88
Estimated Proportion Correctly Classified*: Total = 0.88, Proficient & Above = 0.89					
	429–650	0.00	0.00	0.00	0.00
Decision	396–428	0.02	0.05	0.04	0.12
Consistency	240–395	0.02	0.09	0.77	0.88
Estimated Proportion Consistently Classified*: Total = 0.83 , Proficient & Above = 0.85					

*Inconsistencies within category cell entries are due to rounding.

Table 12.13 Decision Accuracy and Consistency: MD Mod-HSA English April 2009 Form

Form 209	Placement	Advanced	Proficient	Basic	Category
	Scores				Total*
	429–650	0.01	0.00	0.00	0.01
Decision	396–428	0.01	0.07	0.04	0.12
Accuracy	240–395	0.01	0.05	0.81	0.87
Estimated Proportion Correctly Classified*: Total = 0.89, Proficient & Above = 0.90					
	429–650	0.01	0.00	0.00	0.01
Decision	396–428	0.02	0.06	0.05	0.12
Consistency	240–395	0.02	0.08	0.78	0.87
Estimated Proportion Consistently Classified*: Total = 0.84 , Proficient & Above = 0.86					

*Inconsistencies within category cell entries are due to rounding.

Table 12.14 Decision Accuracy and Consistency: MD Mod-HSA English May 2009 Form

Form 109	Placement	Advanced	Proficient	Basic	Category
	Scores				Total*
	429–650	0.01	0.00	0.00	0.01
Decision	396–428	0.01	0.06	0.04	0.11
Accuracy	240–395	0.02	0.06	0.81	0.88
Estimated Proportion Correctly Classified*: Total = 0.88, Proficient & Above = 0.89					
	429–650	0.01	0.00	0.00	0.01
Decision	396–428	0.02	0.05	0.04	0.11
Consistency	240–395	0.02	0.08	0.78	0.88
Estimated Proportion Consistently Classified*: Total = 0.83 , Proficient & Above = 0.85					

*Inconsistencies within category cell entries are due to rounding.

Table 12.15 Decision Accuracy and Consistency: MD Mod-HSA English Summer 2009 Form

Form 309	Placement Scores	Estimated Proportion within Category			Category
		Advanced	Proficient	Basic	Total
	429–650	0.01	0.01	0.00	0.02
Decision	396–428	0.00	0.04	0.03	0.07
Accuracy	240–395	0.01	0.06	0.84	0.91
Estimated Proportion Correctly Classified* = 0.89 ; Proficient & Above = 0.90					
	429–650	0.01	0.01	0.00	0.02
Decision	396–428	0.00	0.03	0.03	0.07
Consistency	240–395	0.02	0.09	0.80	0.91
Estimated Proportion Consistently Classified* = 0.85; Proficient & Above = 0.86					
Form 409					
	429–650	-	-	-	-
Decision	396–428	-	-	-	-
Accuracy	240–395	-	-	-	-
Insufficient sample size < 50					
	429–650	-	-	-	-
Decision	396–428	-	-	-	-
Consistency	240–395	-	-	-	-
Insufficient sample size < 50					

*Inconsistencies within category cell entries are due to rounding.

Table 12.16 Decision Accuracy and Consistency: MD Mod-HSA Government October 2008 Form

Form 108	Placement Scores	Estimated Proportion Within Category		Category Total
		Proficient	Basic	
Decision Accuracy	394–650	0.14	0.06	0.20
	240–393	0.06	0.74	0.80
Estimated Proportion Correctly Classified* = 0.88				
Decision Consistency	394–650	0.13	0.07	0.20
	240–393	0.10	0.70	0.80
Estimated Proportion Consistently Classified* = 0.84				

*Inconsistencies within category cell entries are due to rounding.

Table 12.17 Decision Accuracy and Consistency: MD Mod-HSA Government January 2009 Form

Form 209	Placement Scores	Estimated Proportion Within Category		Category Total
		Proficient	Basic	
Decision Accuracy	394–650	0.12	0.03	0.16
	240–393	0.06	0.78	0.84
Estimated Proportion Correctly Classified* = 0.90				
Decision Consistency	394–650	0.11	0.04	0.16
	240–393	0.10	0.75	0.84
Estimated Proportion Consistently Classified* = 0.86				

*Inconsistencies within category cell entries are due to rounding.

Table 12.18 Decision Accuracy and Consistency: MD Mod-HSA Government April 2009 Form

Form 209	Placement Scores	Estimated Proportion Within Category		Category Total
		Proficient	Basic	
Decision Accuracy	394–650	0.12	0.04	0.16
	240–393	0.06	0.78	0.84
Estimated Proportion Correctly Classified* = 0.89				
Decision Consistency	394–650	0.11	0.05	0.16
	240–393	0.10	0.74	0.84
Estimated Proportion Consistently Classified* = 0.85				

*Inconsistencies within category cell entries are due to rounding.

Table 12.19 Decision Accuracy and Consistency: MD Mod-HSA Government May 2009 Form

Form 109	Placement Scores	Estimated Proportion Within Category		Category Total
		Proficient	Basic	
Decision Accuracy	394–650	0.18	0.07	0.25
	240–393	0.05	0.70	0.75
Estimated Proportion Correctly Classified* = 0.88				
Decision Consistency	394–650	0.17	0.08	0.25
	240–393	0.09	0.67	0.75
Estimated Proportion Consistently Classified* = 0.83				

*Inconsistencies within category cell entries are due to rounding.

Table 12.20 Decision Accuracy and Consistency: MD Mod-HSA Government Summer 2009 Form

Form 309	Placement Scores	Proficient	Basic	Category
				Total*
Decision Accuracy	394–650	0.06	0.04	0.10
	240–393	0.07	0.82	0.90
Estimated Proportion Correctly Classified*: Total = 0.88				
Decision Consistency	394–650	0.06	0.04	0.10
	240–393	0.13	0.77	0.90
Estimated Proportion Consistently Classified*: Total = 0.83				
Form 409				
Decision Accuracy	394–650	-	-	-
	240–393	-	-	-
Insufficient sample size < 50				
Decision Consistency	394–650	-	-	-
	240–393	-	-	-
Insufficient sample size < 50				

*Inconsistencies within category cell entries are due to rounding.