NAB™

Neuropsychological Assessment Battery™

Psychometric and Technical Manual

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Validity of NAB Score Interpretation

The validity of a test refers to the degree to which the test measures the construct(s) it is designed to measure (Anastasi & Urbina, 1997). The establishment of the validity of a test or test battery is a dynamic process, beginning with the design and selection of the test items and content and progressing through numerous, ongoing investigations both before and after a test or test battery is published for clinical use. This chapter summarizes the initial evidence for the validity of the NAB. Evidence for the following types of validity are presented: (a) content validity, or evidence based on theory and test content; (b) construct validity, or evidence based on intercorrelations, factor analyses, and the relationships between the Screening Domain scores and module index scores; and (c) criterion validity, or evidence based on the relationships between NAB scores and other external tests purported to measure similar (convergent validity) or dissimilar (divergent validity) constructs.

In addition, evidence for the clinical utility and sensitivity of the NAB is provided through descriptions of NAB performance by a variety of clinical patient groups, including patients with dementia, aphasia, traumatic brain injury, multiple sclerosis, human immunodeficiency virus/acquired immunodeficiency syndrome, and attention-deficit/hyperactivity disorder. Initial evidence for the ecological validity of the NAB Screening Module is presented and based on a study of patients undergoing inpatient rehabilitation who received the NAB Screening Module along with the Functional Independence Measure (FIM; Granger, Hamilton, & Sherwin, 1986) and ratings of cognitive functioning by nursing staff and physical and occupational therapists. Finally, results are described for a simulated malingering study in which the NAB and several tests of symptom validity/effort were administered to a group of 50 experimental simulators.

Although the data presented in this chapter support the validity of the NAB, these data and analyses should be considered only the beginning steps in the ongoing process of test validation. It is hoped that subsequent investigations will replicate and extend these initial findings.

EVIDENCE BASED ON THEORY AND TEST CONTENT

Reviews of the neuropsychological literature (e.g., Hebben & Milberg, 2002; Lezak, 1995; Mapou & Spector, 1995; Mitsrushina et al., 1998; Spreen & Strauss, 1998; Williamson et al., 1996) have identified seven major functional domains included in neuropsychological assessment: (a) attention and information processing (including working memory); (b) language and verbal communicative functions; (c) spatial/perceptual skills; (d) learning and memory; (e) executive functions and problem-solving abilities; (f) sensorimotor functions; and (g) personality, emotional, and adaptive functions. This conceptual framework has been confirmed with factor analytic studies of various neuropsychological batteries (Ardilla, Galeano, & Rosselli, 1998; Larrabee & Curtiss, 1992; Leonberger et al., 1992; Ponton, Gonzalez, Hernandez, Herrera, & Higareda, 2000) and served as the underlying structure throughout the development of the NAB.

As described in more detail in chapter 2 of this manual, and in the *NAB Administration, Scoring, and Interpretation Manual* (Stern & White, 2003), results of the publisher's survey of neuropsychological needs and practices (Stern & White, 2000) led to decisions pertaining to the final content composition of the NAB. Those results provided strong support for organizing the NAB into a Screening Module and five main modules corresponding to functional domains: Attention Module, Language Module, Memory Module, Spatial Module, and Executive Functions Module. Survey respondents reported a strong preference for continuing to use existing measures of sensorimotor functions and personality/emotional functions; that is, the preference was to not create additional measures of these functions for a newly developed battery.

Content-related validity deals with the issue of how well a group of items or tests is representative of the previously defined domain or domains of interest. Evidence of content-related validity is typically obtained from knowledgeable experts who examine the test material and make judgments about the appropriateness of each item and/or test and the overall coverage of the domain. In addition, content validity is often evaluated in terms of the procedures and plans used in test construction.

Chapter 2 of this manual presents the rationale and theoretical underpinnings of the specific test content. The procedures used in creating each test are also discussed, including the ratings and guidance provided by the NAB Advisory Council and other consultants. These descriptions provide support for the content-related validity of each test and for the modular structure of the NAB.

NORMATIVE SAMPLE FOR THE VALIDITY ANALYSES

One of the primary characteristics of the NAB is the availability of demographically corrected normative data. As discussed in the *NAB Administration, Scoring and Interpretation Manual* (Stern & White, 2003), NAB norms based on the demographically corrected standardization sample (N = 1,448) are recommended for most clinical situations in which the referral question involves inferring brain–behavior relationships. *Therefore, all of the validity data presented in this chapter are based on the demographically corrected standardization sample, unless otherwise specified.* Note that highly similar results were obtained with the age-based, U.S. Census-matched standardization sample (N = 950).

EVIDENCE BASED ON INTERNAL STRUCTURE

Intercorrelations of NAB Test and Index Scores

Screening Module

The intercorrelations for the NAB demographically corrected standardized scores (T scores and standard scores) are presented in Tables C.1 through C.6 of Appendix C. The correlations range from .16 (for the correlation between the Screening Attention Domain score and Screening Language Domain score and also between the Screening Language Domain score and Screening Executive Functions Domain score) to .45 (for the correlation between the Screening Attention Domain score and the Screening Executive Functions Domain score). The Total Screening Index, as expected, correlates very strongly with the Screening Domain scores, ranging from .53 for the correlation with the Screening Language Domain score to .70 for the correlation with the Screening Executive Functions Domain.

A similar pattern is found for the module index score intercorrelations. The correlations are all positive and all range from the .40s to .50s (see Table C.1). The lowest correlation is .47 (between the Attention Index score and the Language Index score and between the Language Index score and the Memory Index score). The highest correlation is between the Attention Index score and the Executive Functions Index score (r = .59). As with the Total Screening Index score, the Total NAB Index score correlates highly with the module index scores. Correlations between the Total NAB Index score and the module index scores range from .75 (for the correlation with the Language Index score) to .81 (for the correlation with the Executive Functions Index score).

As expected, the intercorrelations of the Screening Domain scores with the module index scores show that the Screening Domain scores generally have the highest correlations with their respective main module index score counterparts. The correlations range from .35 (for the correlation between the Screening Language Domain score and the Language Index score) to .78 (for the correlation between the Screening Attention Domain score and the Attention Index score). The Total Screening Index score and the Total NAB Index score have a very high correlation (r = .79).

Attention Module

The intercorrelations among the Attention Module primary scores (see Table C.2) are all positive, except for some expected negative correlations (e.g., the correlation between Numbers & Letters Part D Disruption and Numbers & Letters Part A Speed). Each Attention Module primary score correlates more strongly with the Attention Index score than with the other module index scores. In general, the Attention Module primary scores also have their highest correlations with the Screening Attention Domain score. Two notable exceptions are Dots and Driving Scenes, which show moderate correlations with most of the Screening Domain scores.

Language Module

The intercorrelations between the Language Module primary scores (see Table C.3) are all positive and relatively low, likely due to the expected limited variability in Language Module scores in a healthy nonimpaired population. The Writing subtest shows the lowest relationships with the other Language Module primary scores. Each Language Module primary score correlates more strongly with the Language Index score than with the other module index scores, although moderate correlations occur between the Language Module primary scores and the other module index scores. The correlations are highly variable between the Language Module primary scores and the Screening Language Domain score.

Memory Module

All intercorrelations between the Memory Module primary scores (see Table C.4) are in the positive direction, and many are in the moderate to high range. As expected, the immediate and delayed counterparts for all of the memory measures show the highest correlations. For all four of the Memory tests (List Learning, Shape Learning, Story Learning, and Daily Living Memory), the immediate recall/recognition trial of a test should have higher correlations with the delayed recall/recognition trials of that same test than it does with scores from the other memory tests. Each Memory Module primary score correlates higher with the Memory Index score than with the other module index scores. The Memory Module primary scores have moderate correlations with the Screening Memory Domain score.

Spatial Module

The intercorrelations between the Spatial Module primary scores (see Table C.5) are all positive, and most are in the low to moderate range. As with the other modules, each Spatial Module primary score correlates more strongly with the Spatial Index score than with the other module index scores. The same general pattern of correlations is also seen between the Screening Spatial Domain score and the Spatial Module primary scores, with the exceptions of Figure Drawing Copy Organization (FGD–cpy:org) and Map Reading (MAP) scores. Although these primary scores show moderate correlations with the Screening Spatial Domain score, the highest correlation is between the Design Construction (DES) score and the Screening Spatial Domain score.

Executive Functions Module

Finally, for the Executive Functions primary scores (see Table C.6), the intercorrelations are all positive and most are in the moderate range. Each Executive Functions Module primary score correlates more strongly with the Executive Functions Index score than with the other module index scores. The Executive Functions primary scores also show the same general pattern of correlations with the Screening Domain scores, with the notable exception of the Judgment (JDG) test, for which the correlations with the other Screening Domain scores are similar to the correlation with the Screening Executive Functions Domain score.

Summary of Intercorrelations

In summary, the intercorrelations among the Screening Domain scores, module index scores, and module primary scores generally show a consistent pattern of convergent and divergent validity. In all cases, the module primary scores correlate most highly with the module index score that subsumes them. A similar, but less consistent, pattern is seen with the correlations between the module primary scores and the Screening Domain scores. Tables C.7 through C.12 in Appendix C report the analogous correlations for the U.S. Census-matched standardization sample. The pattern of intercorrelations for the U.S. Census-matched sample is very similar to that observed for the demographically corrected standardization sample.

Factor Analyses

Exploratory Factor Analyses

Screening Module. The constructs that underlie NAB scores were examined with exploratory factor analyses (EFA). A small number of standardization cases were eliminated from the analyses due to missing data. Therefore, a total of 1,417 cases were analyzed in the various exploratory factor analyses. Separate factor analyses were performed for the primary scores of the Screening Module and the primary scores of the main modules. The following Screening Module primary scores were analyzed: Screening Digits Forward (S-DGF) and Screening Digits Backward (S-DGB), the arithmetic average of Screening Numbers & Letters Parts A Efficiency and Part B Efficiency (S-N&$L_{A\&B}$–eff), Screening Auditory Comprehension (S-AUD), Screening Naming (S-NAM), Screening Visual Discrimination (S-VIS), Screening Design Construction (S-DES), Screening Mazes (S-MAZ), Screening Word Generation (S-WGN), Screening Shape Learning Delayed Recognition (S-SHL–drg), and Screening Story Learning Delayed Recall (S-STL–drc). The S-N&L_A–eff and S-N&L_B–eff scores were averaged in order to eliminate a method variance artifact. Screening Shape Learning Immediate Recognition (S-SHL–irg) and Screening Story Learning Immediate Recall (S–STL-irc) were not included in the EFA for the same reason. The delayed memory scores were preferred over the immediate memory scores because immediate memory is often more highly related to attentional processes, and delayed memory more closely approximates the traditional conceptualization of what is considered episodic or explicit memory.

All EFAs were conducted with Version 11.5 of SPSS-PC. Factors were extracted by principal axis factoring followed by Promax rotation of retained factors. For both the Screening Module primary scores and the main module primary scores, three- to six-factor solutions were examined. All factor solutions were interpreted according to traditional methods (e.g., evaluation of scree plot and eigenvalues). The theoretical underpinnings of the NAB and the meaningfulness of the constructs were examined according to the recommendations of Gorsuch (1983a, 1996). This process lent some support for two separate factor solutions for the Screening Module primary scores: a four-factor solution (see Table 6.1) and a five-factor solution (see Table 6.2).

For the Screening Module primary score EFAs, the percentages of variance accounted for by the four- and five-factor solutions were 57.8% and 66.5%, respectively. The four-factor solution includes separate but related factors for Attention, Psychomotor Speed, Memory, and Spatial Skills/ Language. The five-factor solution suggests factors of Attention, Psychomotor Speed, Memory, Spatial Skills, and Language. In these solutions, Screening Executive Functions primary scores did not result in distinct factors. Screening Mazes (S-MAZ) and the averaged Screening Numbers & Letters Efficiency (S-N&$L_{A\&B}$–eff) scores tended to form a single factor, likely due to the common underlying element of psychomotor speed. Also, Screening Word Generation (S-WGN) loaded more with the memory subtests, a result suggesting S-WGN involves an underlying retrieval process.

Main Modules. The factor analyses for the main modules included the following primary scores: Digits Forward (DGF), Digits Backward (DGB), Dots (DOT), an average of Numbers & Letters Parts A, B, C, and D Efficiency (N&$L_{A, B, C, D}$–eff), Driving Scenes (DRV), Oral Production (OPD), Auditory Comprehension (AUD), Naming (NAM), Writing (WRT), Bill Payment (BIL), List Learning List A Long Delayed Recall (LLA–ld:drc), Shape Learning Delayed Recognition (SHL–drg), Story Learning Phrase Unit Delayed Recall (STL–drc:phu), Daily Living Memory Delayed Recall (DLM–drc), Visual Discrimination (VIS), Design Construction (DES), Figure Drawing Copy (FGD–cpy), Map Reading (MAP), Mazes (MAZ), Judgment (JDG), Categories (CAT), and Word Generation (WGN). As with the choice of variables for the Screening Module EFAs, an average of the N&L Efficiency scores was used, and only delayed memory tasks were included in the analyses, so that artificial factors due to method variance were avoided. Additionally, Figure Drawing Copy Organization (FGD–cpy:org) was excluded from the analyses due to method variance issues.

The factor solutions for the main module primary score EFAs are presented in Tables 6.3 and 6.4. The five- and six-factor models accounted for 48.3% and 52.8% of the variance, respectively. Table 6.3 presents a five-factor solution that includes the following distinct factors: Memory, Spatial Skills, Attention, Executive Functions/Psychomotor Speed, and Language. The six-factor solution presented in Table 6.4 suggests the following distinct factors: Spatial Skills, Memory, Attention, Psychomotor Speed, Language, and Executive Functions.

Even though the module index scores are organized into conceptual cognitive areas, it was fully recognized from the inception of development of the NAB that there is considerable construct overlap in many of the conceptual domains measured by the NAB and that many of the NAB tests are

Table 6.1
NAB Screening Module Primary Score Subset: Exploratory Factor Pattern Loadings for Four-Factor Solutions

Test	Acronym	Attention	Psychomotor Speed	Memory	Spatial Skills/ Language
Screening Digits Forward	S-DGF	.79			
Screening Digits Backward	S-DGB	.65			
Screening Mazes	S-MAZ		.85		
Screening Numbers & Letters Efficiency (Parts A and B)	S-N&$L_{A\&B}$–eff		.47		–.18
Screening Story Learning Delayed Recall	S-STL–drc			.63	
Screening Word Generation	S-WGN	.20	.12	.36	
Screening Shape Learning Delayed Recognition	S-SHL–drg			.24	
Screening Visual Discrimination	S-VIS				.40
Screening Auditory Comprehension	S-AUD				.38
Screening Naming	S-NAM				.33
Screening Design Construction	S-DES		.22		.25

Note. The Screening Numbers & Letters Efficiency score is an arithmetic average of the scores for Parts A & B. Factor loadings less than an absolute value of .10 were intentionally left blank. 53.9% of the variance was accounted for with this four-factor solution.

Table 6.2
NAB Screening Module Primary Score Subset: Exploratory Factor Pattern Loadings for Five-Factor Solutions

Test	Acronym	Attention	Psychomotor Speed	Memory	Spatial Skills	Language
Screening Digits Forward	S-DGF	.81				
Screening Digits Backward	S-DGB	.62				
Screening Numbers & Letters Efficiency (Parts A and B)	S-N&L$_{A\&B}$–eff		.64		–.12	
Screening Mazes	S-MAZ		.62		.13	
Screening Story Learning Delayed Recall	S-STL–drc			.65		
Screening Word Generation	S-WGN	.20		.35		
Screening Shape Learning Delayed Recognition	S-SHL–drg			.23		
Screening Design Construction	S-DES				.77	
Screening Auditory Comprehension	S-AUD					.47
Screening Naming	S-NAM					.37
Screening Visual Discrimination	S-VIS				.13	.24

Note. The Screening Numbers & Letters Efficiency score is an arithmetic average of the scores for Parts A & B. Factor loadings less than an absolute .10 were intentionally left blank. 62.3% of the variance was accounted for by this five-factor solution.

multifactorial in nature. Furthermore, some tests are more dependent on speeded performance than others, and the modality of test stimulus presentation also affects the factor loadings. Although the exploratory factor solutions presented in this section vary somewhat from solution to solution, the EFAs do lend evidence, in general, that the NAB measures multiple conceptual domains and that the factor structure is highly consistent with the modular development and the related conceptual neuropsychological domains. The subsequent section describes the results of confirmatory factor analysis (CFA) methods that were used to compare and contrast the model-fit of the obtained EFA factor solutions.

Although the NAB test content and resulting test score configurations were based on an extensive review of the neuropsychological literature and multiple iterations of refining the test measures, the hypothesized internal structure was examined empirically with exploratory factor analytic (EFA) techniques. These analyses were conducted as a means of forming additional hypotheses regarding the number and composition of the latent factors that underlie the observed data. Although there are a number of criticisms of EFA methodology (e.g., Mulaik, 1987; Nunnally, 1978), the EFAs presented lend a degree of evidence of a multifactorial battery. Furthermore, most of the factors extracted by the EFA solutions show a fair degree of concordance with the NAB conceptual model of neuropsychological constructs.

One consistent finding of the EFAs suggests a potential construct that can be conceptualized as psychomotor speed. Consequently, this hypothesis was evaluated in the construct-testing process of the subsequent confirmatory factor analysis (CFA). The reader should also be aware that factor solutions obtained from EFA many times show inadequate fits when applied to CFA (Van Prooijen & Van der Kloot, 2001). The primary difference between EFA and CFA is in their purpose: The former methodology is often used to explore or generate hypotheses, whereas the latter is intended as a theory or construct evaluation procedure (Stevens, 1996). As such, CFA results bear directly on establishing the validity of the NAB Domains and Indexes.

Confirmatory Factor Analyses

Through its organizational structure of the Screening Domain scores, the Total Screening Index score, the module index scores, and Total NAB Index score, the NAB is intended to tap into a variety of functional neuropsychological domains. As previously noted, however, some measures were constructed to be more or less unidimensional, whereas other measures are clearly multidimensional in nature, requiring multiple cognitive processes to successfully perform the task. Therefore, it was anticipated that an adequate fit (i.e., via CFA methodology) would require correlated factors and would likely result in a number of cross- or shared-factor loadings.

Table 6.3
NAB Module Primary Score Subset:
Exploratory Factor Pattern Loadings for Five-Factor Solutions

Test	Acronym	Memory	Spatial Skills	Attention	Executive Functions/ Psychomotor Speed	Language
List Learning List A Long Delayed Recall	LLA-ld:drc	.75				
Daily Living Memory Delayed Recall	DLM–drc	.69				
Story Learning Phrase Unit Delayed Recall	STL–drc:phu	.57				
Driving Scenes	DRV	.31	.15	–.10	.16	.21
Writing	WRT	.15				
Design Construction	DES		.53		.28	
Visual Discrimination	VIS		.53			
Shape Learning Delayed Recognition	SHL–drg	.21	.43			
Map Reading	MAP		.42			.33
Dots	DOT	.11	.40	.13	.19	–.22
Figure Drawing Copy	FGD–cpy		.37			
Digits Backward	DGB			.75		
Digits Forward	DGF			.70		
Word Generation	WGN			.37	.18	.19
Mazes	MAZ	–.15	.14	–.10	.71	
Numbers & Letters Efficiency (Parts A, B, C, D)	$N\&L_{A,B,C,D}$–eff				.58	
Categories	CAT		–.10		.37	.34
Auditory Comprehension	AUD			.10		.49
Judgment	JDG					.42
Bill Payment	BIL		.24		–.11	.34
Naming	NAM		.21			.34
Oral Production	OPD		–.13		.23	.31

Note. The Numbers & Letters Efficiency score is an arithmetic average of Parts A, B, C, and D. Factor loadings less than an absolute value of .10 were intentionally left blank.

Screening Module. A CFA conceptual representation of the constructs measured by the Screening Module is shown in Figure 6.1. The observed variables (the tests, represented by the 11 rectangles) are positioned next to the latent construct or "factors" that correspond to the Screening Domain; those constructs are represented by the five ovals. The arrows from factors to tests spell out the factor structure tested in the analysis. For example, S-DGF (Screening Digits Forward) loaded on the Screening Attention factor. Additionally, for each observed score, an error or residual term accounts for the variance not accounted for in the observed CFA model and is represented by the 11 smaller ovals. For the most part, the observed variables used in the CFA model corresponded directly to the Screening primary scores. There were, however, two exceptions. First, similar to the EFA primary score set, only the delayed memory scores (Screening Shape Learning Delayed Recognition and Screening Story Learning Delayed Recall) were included in the model. Second, the arithmetic average of Screening Numbers & Letters Part A Efficiency (S-$N\&L_A$–eff) and Part B Efficiency (S-$N\&L_B$–eff) scores were included due to the rationale explained in the discussion of the EFA analyses.

CFAs were performed with the AMOS (Version 4.0) structural equation modeling software program (Arbuckle & Wothke, 1999). First, the Screening Module domains, as represented by the five Screening Domain scores, were analyzed

Table 6.4
NAB Module Primary Score Subset: Exploratory Factor Pattern Loadings for Six-Factor Solution

Test	Acronym	Spatial Skills	Memory	Attention	Psycho-motor Speed	Language	Executive Functions
Design Construction	DES	.56			.22		
Visual Discrimination	VIS	.53			–.11	.13	
Dots	DOT	.48		.15		–.22	
Shape Learning Delayed Recognition	SHL–drg	.46	.18				
Map Reading	MAP	.42	–.11			.29	
Figure Drawing Copy	FGD–cpy	.34				.17	–.12
List Learning List A Long Delayed Recall	LLA–ld:drc		.72				
Daily Living Memory Delayed Recall	DLM–drc		.70				
Story Learning Phrase Unit Delayed Recall	STL–drc:phu		.56				
Driving Scenes	DRV	.22	.28				.28
Digits Backward	DGB	.11		.79			
Digits Forward	DGF			.65		.10	
Word Generation	WGN	–.11		.35	.20	.22	
Mazes	MAZ	.10	–.11	–.12	.80		
Numbers & Letters Efficiency (Parts A, B, C, D)	$N\&L_{A,B,C,D}$–eff				.55		
Auditory Comprehension	AUD					.50	
Naming	NAM	.14				.41	
Bill Payment	BIL	.17				.40	
Writing	WRT		.18			.24	–.21
Oral Production	OPD						.70
Categories	CAT				.21		.35
Judgment	JDG					.23	.27

Note. The Numbers & Letters Efficiency score is an arithmetic average of Parts A, B, C, and D. Factor loadings less than an absolute .10 were intentionally left blank.

with the data from the demographically corrected standardization sample (N = 1,417; 31 standardization cases were excluded for the factor analyses on a list-wise basis due to missing data). The resulting standardized CFA results are shown in Figure 6.2, and the fit statistics/indexes are presented in Table 6.5. Figure 6.2 presents the factor loadings (shown next to the arrows pointing from the NAB factors to the observed Screening primary scores) and the correlations between the NAB factors (shown next to the curved lines between the proposed latent constructs).

Table 6.5 presents the following fit statistics for Models 1, 2, and 3 for the Screening Module: (a) χ^2, (b) degrees of freedom for the model (*df*), (c) the ratio of χ^2 to the degrees of freedom (χ^2:*df*), (d) the Comparative Fit Index (CFI), (e) the root mean square error of approximation (RMSEA), and (f) the Akaike Information Criterion (AIC; Akaike, 1987). It is well documented that the chi-square test (χ^2) is highly influenced by sample size, especially when the sample size is large. Therefore, the CFI and RMSEA fit indexes were given priority over the other fit indexes because they provide more stable and accurate estimates (Hu & Bentler, 1995). Hu and Bentler (1999) demonstrated that RMSEA values at or below .06 and CFI values at or above .95 suggest a good fit of the model to the data. According to this criteria of fit, Model 1 shows an inadequate fit for all of the fit statistics.

A revised model was constructed following an evaluation of Model 1 modification indexes and standardized residuals, along with an analysis of additional abilities measured by

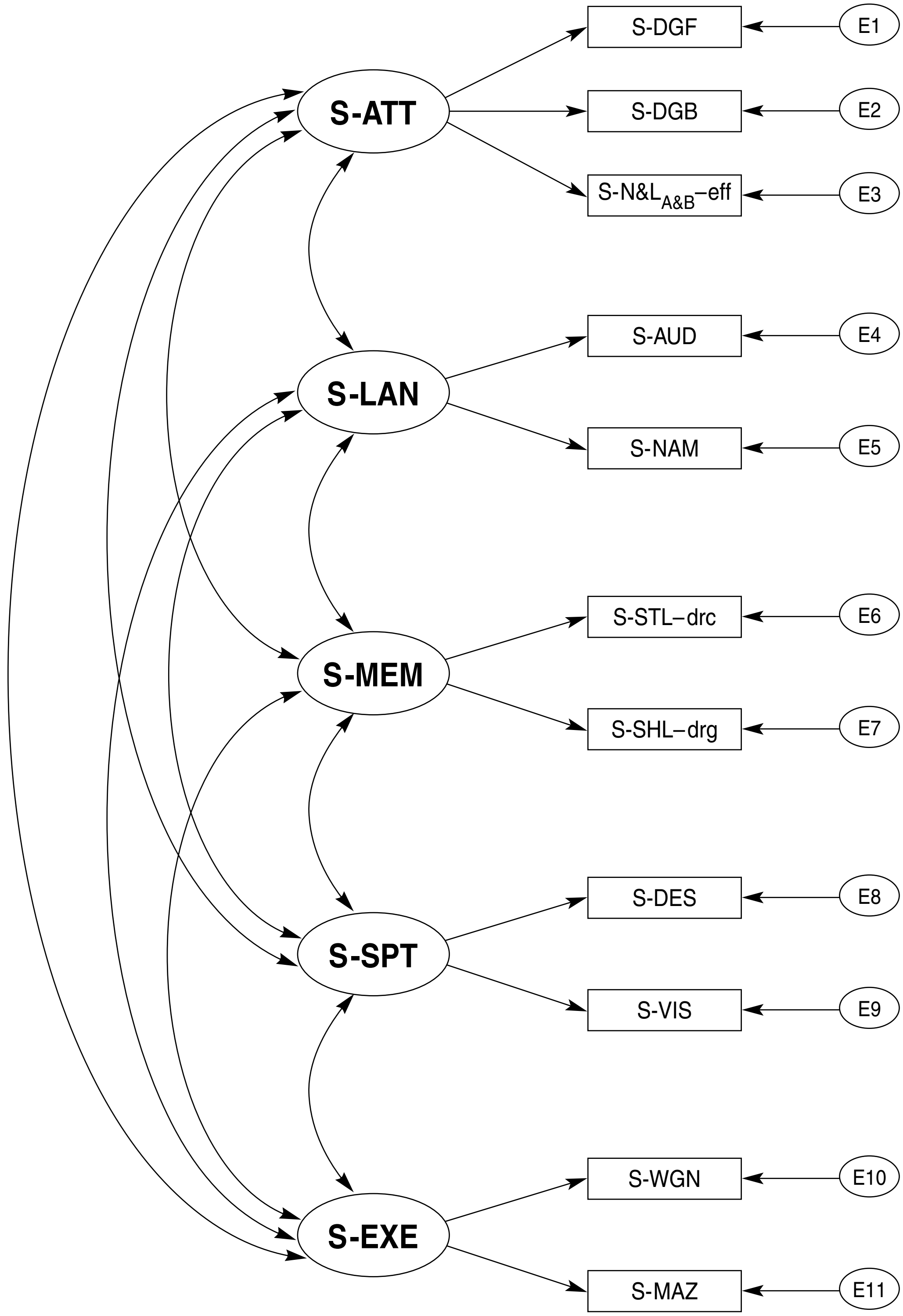

Figure 6.1. NAB Screening Module Confirmatory Factor Analysis (CFA) conceptual model.

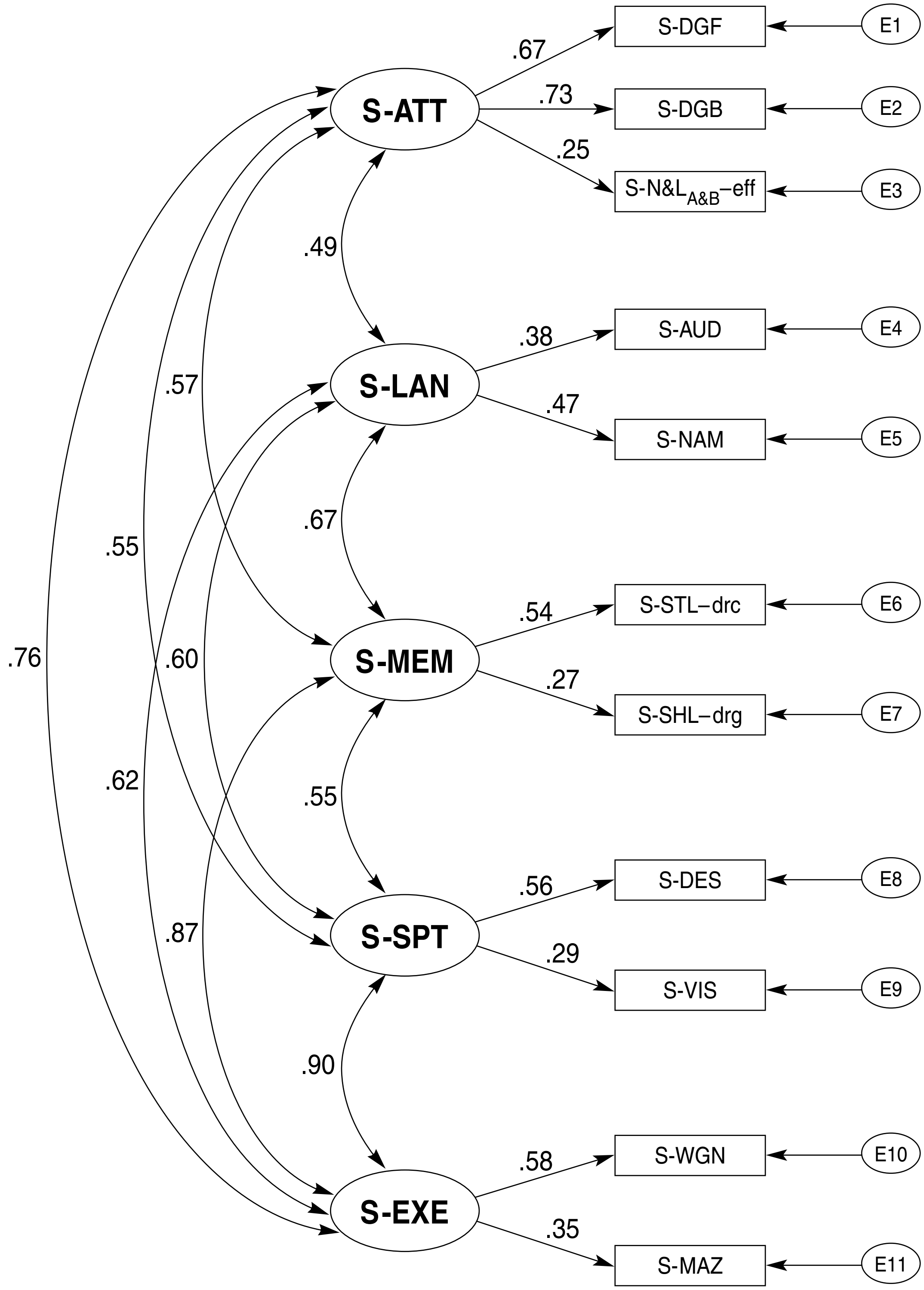

Figure 6.2. NAB Screening Module Confirmatory Factor Analysis (CFA) Model 1.

Table 6.5
Summary of Goodness-of-Fit Statistics for CFA Screening Module for Models 1, 2, and 3

Model	χ^2	*df*	Probability level	χ^2: *df* ratio	CFI	RMSEA	AIC
Model 1	258.384	34	$p < .001$	7.6	.860	.068	322.384
Model 2	58.261	32	$p = .003$	1.8	.984	.024	126.261
Model 3	78.208	34	$p < .001$	2.3	.972	.030	142.208

Note. N = 1,448. *df* = degrees of freedom for the model; CFI = Comparative Fit Index; RMSEA = root mean square error of approximation; AIC = Akaike Information Criteria.

each Screening test. This model, Model 2, is shown in Figure 6.3. Model 2 allowed the residual or error terms between Screening Mazes (S-MAZ) and Screening Design Construction (S-DES) and between Screening Mazes (S-MAZ) and the average score of Screening Numbers & Letters Part A Efficiency and Part B Efficiency (S-N&$L_{A\&B}$–eff) to covary. This modification was suggested by an evaluation of the fit indexes and the evidence from the EFA that a minor speed of processing factor may be present. Note that S-MAZ, S-DES, S-N&L_A–eff, and S-N&L_B–eff all inherently require psychomotor speed for successful performance. As shown in Table 6.5, the fit indexes dramatically improved for Model 2. Because the two models are nested, their fit may be compared by comparing the difference in the chi-squares for the two models in relation to the difference in degrees of freedom. The change in the chi-squares ($\Delta\chi^2$ =200.1, Δdf = 2) was statistically significant ($p < .001$). This finding suggests that Model 1 did not account for all constructs measured by the screening measures; Model 2 took speed into account and appears to be a better representation of the constructs measured.

A final model, Model 3, was tested and is shown in Figure 6.4. This model posits a separate, but related, psychomotor speed factor composed of Screening Mazes (S-MAZ) and the average score of Screening Numbers & Letters Part A Efficiency and Part B Efficiency. Additionally, previous EFA and CFA results suggested that the Screening Word Generation (S-WGN) may be more related to a memory factor than to an executive functions factor. The resultant fit statistics are shown in Table 6.5, Model 3. As can be seen, the fit indexes for Model 3 also suggest that this conceptualization may provide a plausible explanation for observed data.

The Akaike Information Criteria (AIC; shown in Table 6.5) was used to compare the relative fit of Models 2 and 3. This fit index was used because the two models are not nested and thus could not be compared on the basis of the difference in chi-squares for the two models. When the AIC is used, smaller values are better. As shown in the table, according to this criterion, Model 2 provides a better representation of the underlying Screening primary score interrelationships than Model 3. In summary, of the models evaluated, Screening Module Model 2 represents a plausible factorial representation of the underlying Screening Module relations and directly corresponds to the NAB Screening Domains. These data provide very strong construct validity evidence for the NAB Screening Domain scores.

Main Modules. Next, the factor structure of the main NAB modules was evaluated in a similar fashion to that for the Screening Module. A CFA pictorial representation of the constructs defined by the main module primary scores are shown in Figure 6.5. This figure represents all observed module primary scores except the immediate recall/recognition trials of the memory measures for reasons elucidated earlier. CFA analyses were performed with the same structural equation modeling program (AMOS; Arbuckle & Wothke, 1999) used for the Screening Module, and the same slightly reduced demographically corrected standardization sample (N = 1,417). The resulting CFA diagram is shown in Figure 6.6 (Model 1), and the fit statistics/indexes are presented in Table 6.6. The identical model-fit criteria used in the Screening Module analyses were applied to the main NAB Module CFA.

According to the fit index criteria, Model 1 showed an inadequate fit to the NAB standardization data. A revised model (Model 2) was constructed based on an evaluation of the Model 1 modification indexes, standardized residuals, evidence from the Module EFA analyses, as well as a task analysis of NAB modules. The revised model, Model 2, is shown in Figure 6.7. Model 2 allows the residual or error terms to correlate between Digits Forward (DGF) and Digits Backward (DGB), and between most of the measures that appeared to involve significant psychomotor speed. The pattern of speeded measures that was not accounted for in Model 1 is quite similar to the Screening Module results. As seen in Table 6.6, the fit indexes dramatically improved for Model 2; Model 2, in fact, showed a generally good fit to the NAB standardization data. Furthermore, this difference was statistically significant ($\Delta\chi^2$ = 1,027, Δdf = 16, $p < .001$), a finding that suggests that Model 2 provides a better representation of the NAB constructs than the

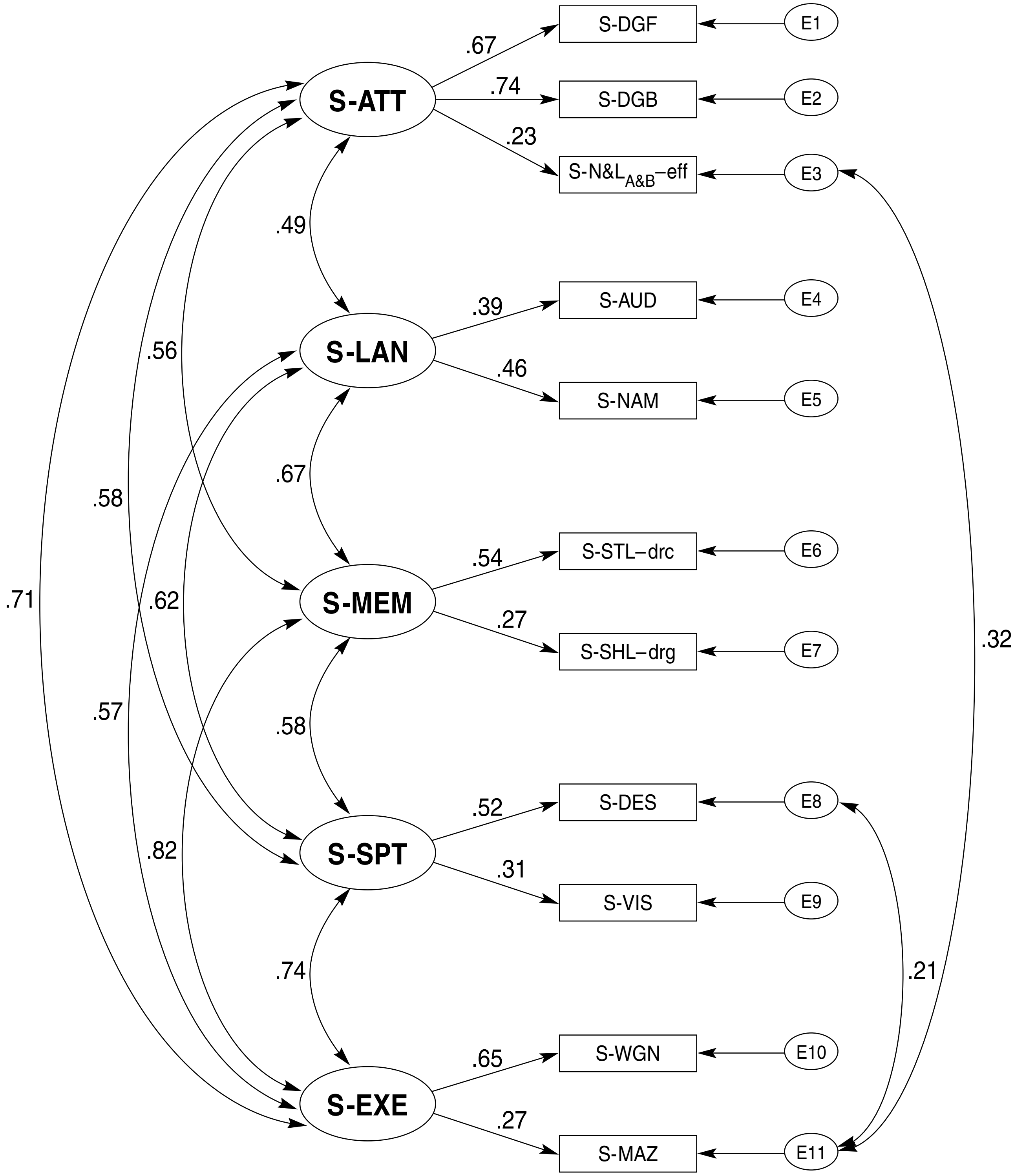

Figure 6.3. NAB Screening Module Confirmatory Factor Analysis (CFA) Model 2.

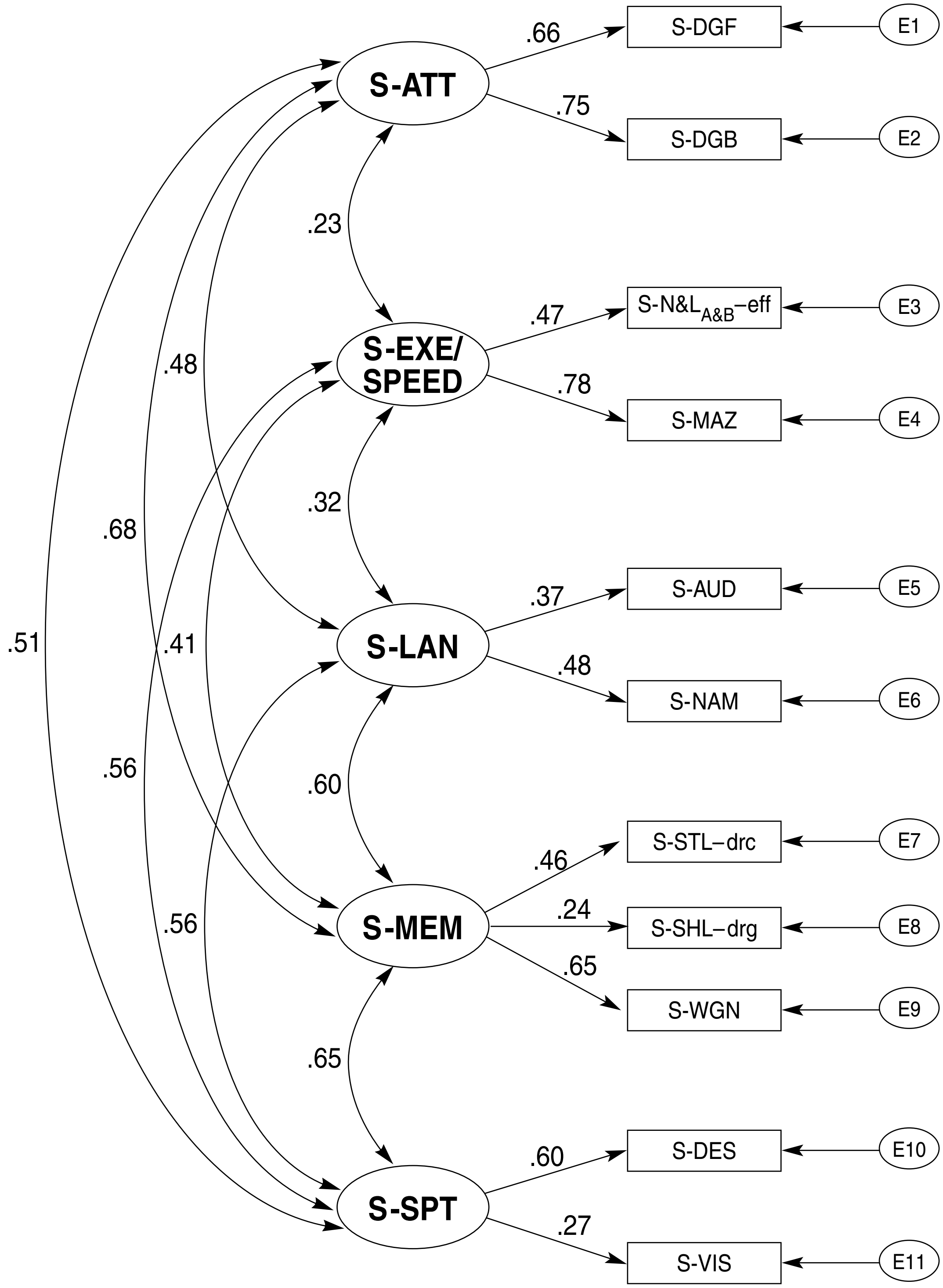

Figure 6.4. NAB Screening Module Confirmatory Factor Analysis (CFA) Model 3.

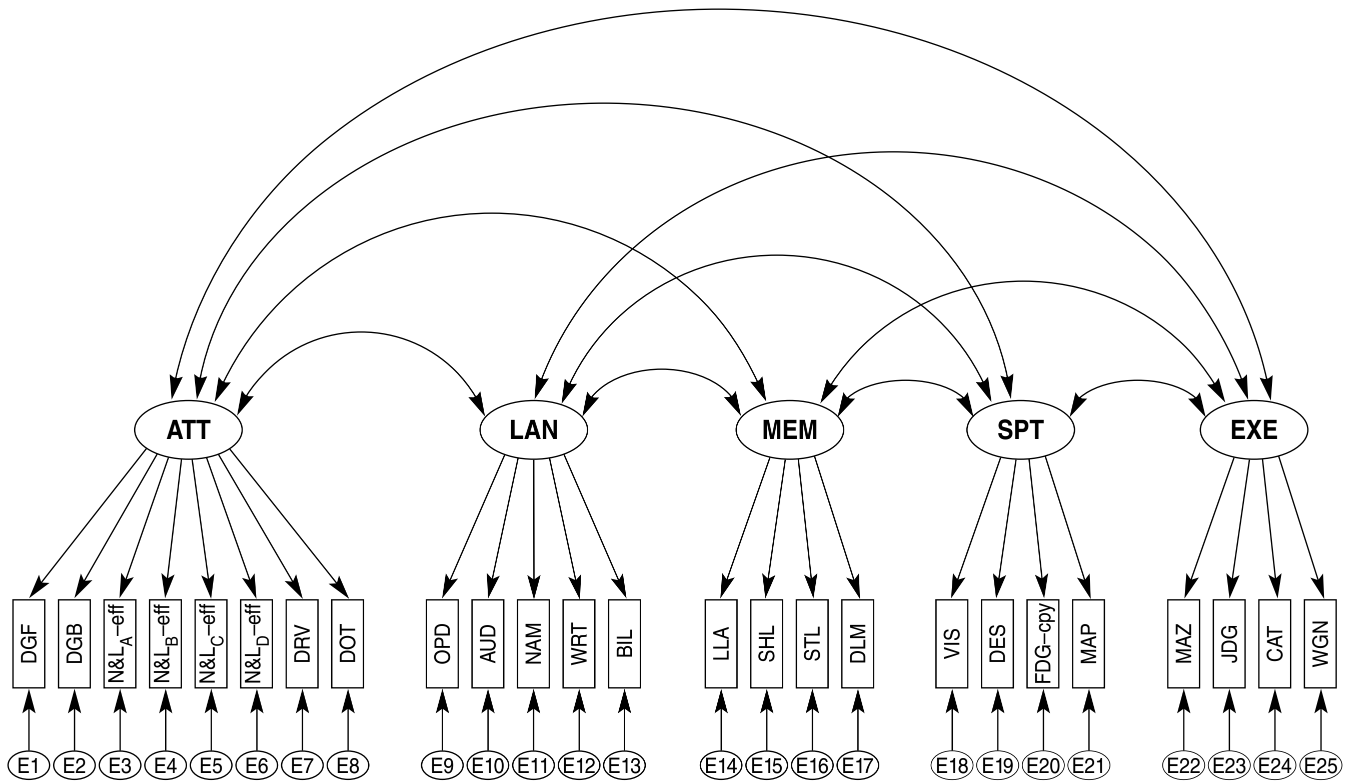

Figure 6.5. NAB Main Module Confirmatory Factor Analysis (CFA) Conceptual Model.

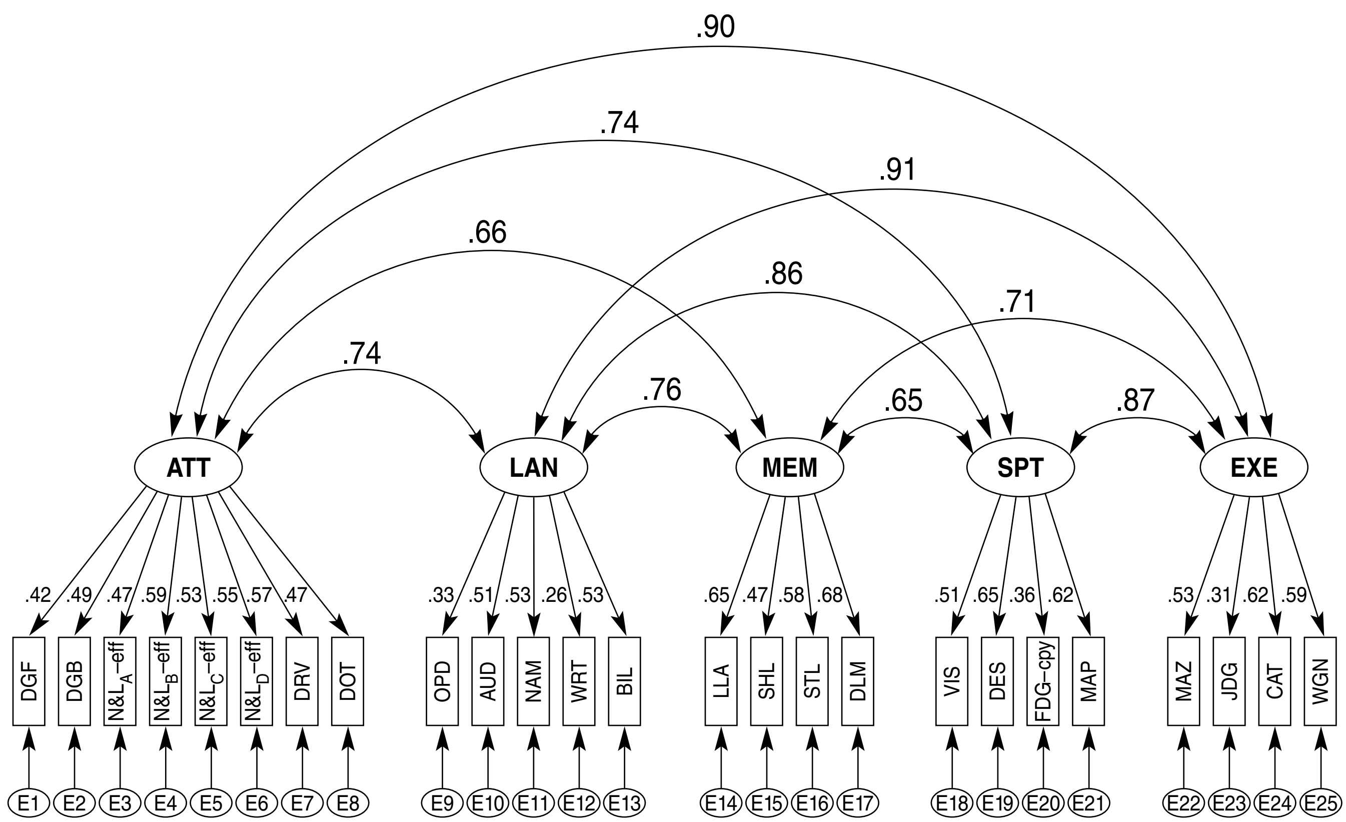

Figure 6.6. NAB Main Module Confirmatory Factor Analysis (CFA) Model 1.

Table 6.6
Summary of Goodness-of-Fit Statistics for the Main NAB Module for Models 1, 2, and 3

Model	χ^2	*df*	Probability level	χ^2: *df* ratio	CFI	RMSEA	AIC
Model 1	1789.561	265	$p < .001$	6.8	.810	.064	1909.561
Model 2	762.462	249	$p = .003$	3.1	.936	.038	914.462
Model 3	465.488	190	$p < .001$	2.4	.958	.032	591.488

Note. *N* = 1,417. *df* = degrees of freedom for the model; CFI = Comparative Fit Index; RMSEA = root mean square error of approximation; AIC = Akaike Information Criteria.

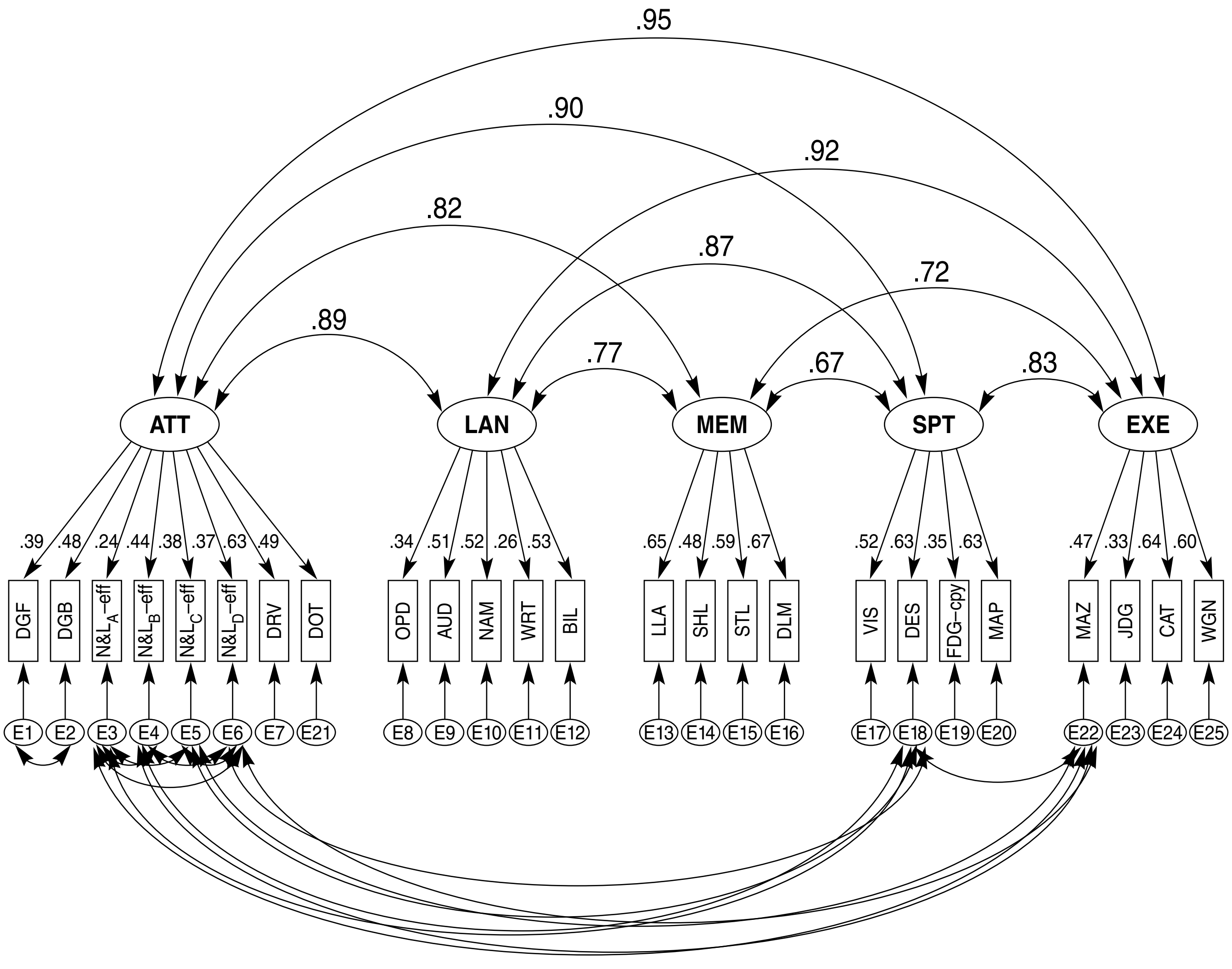

Figure 6.7. NAB Main Module Confirmatory Factor Analysis (CFA) Model 2.

overly strict Model 1. Again, Model 2 took into account the relations among measures that had significant psychomotor speed components. It should also be noted that although all factor loadings and factor correlations in the model shown in Figure 6.7 were statistically significant, some of the correlated errors were quite small and were not statistically significant. However, because these correlated errors were added specifically to account for a minor speed factor, they were left in the analysis even though not statistically significant.

Model 2 results suggested the possible presence of a separate and correlated speed of processing factor and consequently an alternate model (Model 3, see Figure 6.8) was constructed and evaluated. A number of other parameter

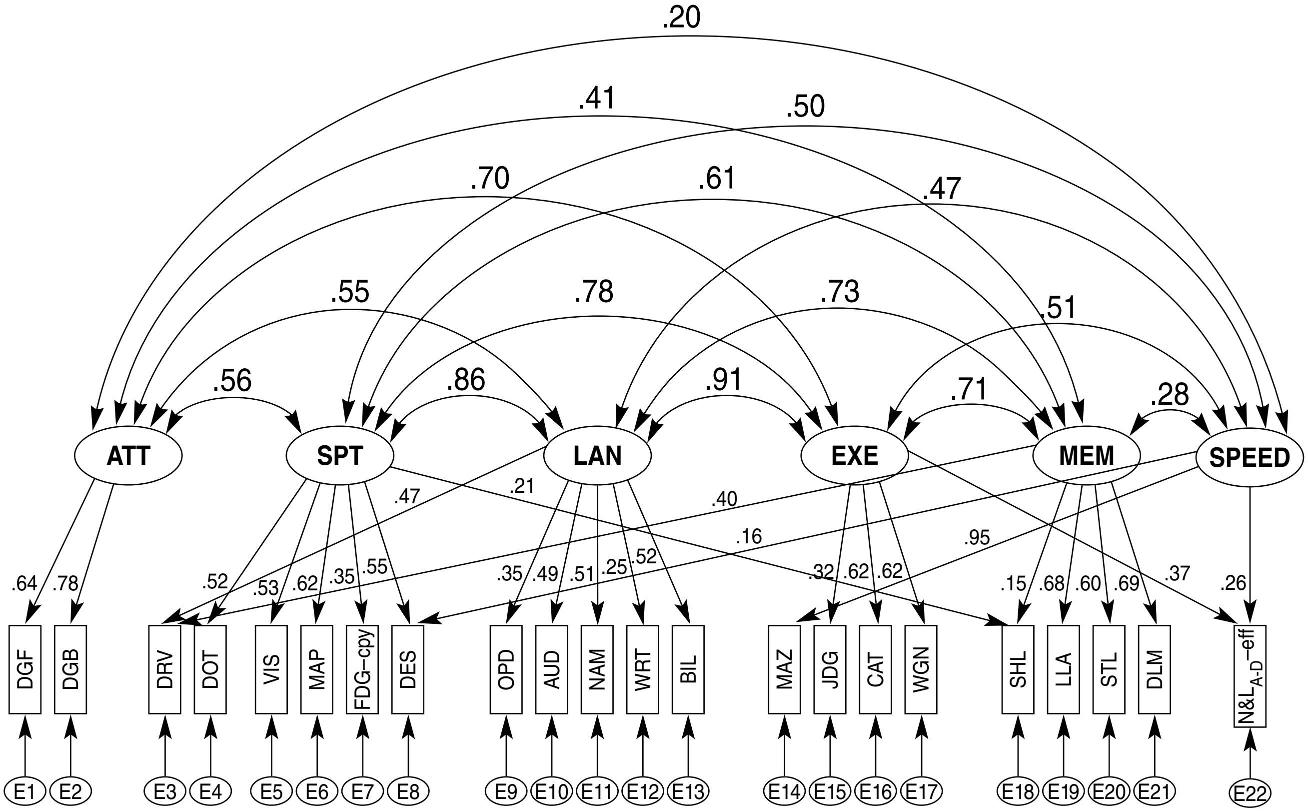

Figure 6.8. NAB Main Module Confirmatory Factor Analysis (CFA) Model 3.

modifications based on theoretical considerations, task analysis, and an evaluation of Model 2's modification indexes, were implemented in Main Module Model 3 as well. The resultant fit statistics for Model 3 are shown in Table 6.6. As can be seen, Model 3 also showed an excellent fit to the observed data. So that the relative fit of Models 2 and 3 could be evaluated, the AIC for each model is shown in the table. The AIC for Model 3 was substantially lower than for Model 2; thus, Model 3 was seen as the better explanation of the constructs underlying the main module primary score relationships.

Summary of confirmatory factor analyses. In summary, of the models evaluated, Model 2 for the Screening Module and Model 3 for the main NAB Modules represent a plausible factorial representation of the underlying relationship and each closely corresponds to the NAB Module Domain/Indexes. However, in contrast to the best-fit Screening Module Model 2, the main module factor structure appears to be more complex and multidimensional in nature. The main module factor structure is more complex in that there are a number of cross-factor or shared loadings between primary scores. For example, in addition to the expected factor loading on the Spatial Module primary scores, the Spatial Index has significant loadings on Dots (a *spatial* working memory and scanning task) and Shape Learning (a *spatial* memory task). Similarly, the Numbers & Letters Efficiency scores (attention measures, based in part on *psychomotor speed*) are related to Design Construction (a timed visuoconstruction task, also based in part on *psychomotor speed*) and Mazes (a timed planning task, again based in part on *psychomotor speed*). Again, these cross-factor loadings were not unexpected and are, in fact, consistent with the theoretical underpinnings of these particular neuropsychological constructs.

Interpretation of NAB performance should always include considerations of the multidimensional nature of these NAB scores. Although the user can have confidence in interpreting the content/constructs of the main module primary scores, these CFA results underscore what is commonly understood in clinical practice: that many cognitive processes are multifactorial in nature. As such, success or failure on a given task should be evaluated carefully in order to determine the various cognitive processes that contribute to performance on a given test.

Relationship Between Screening Domain and Module Index Scores

The relationship between the Screening Domain scores and the module index scores is essentially an issue of the internal structure of the NAB; therefore, these relationships provide additional validity evidence based on the internal structure of the NAB. One of the goals for the design of the NAB was to provide "dual-screening" capability. Specifically, the aim was the construction of Screening Module Domain scores that predict performance on analogous tasks in the main NAB modules at both the severely impaired and above average ends of the index score distribution. The Domain scores from the Screening Module can identify individuals who are so impaired that they are expected to obtain similarly impaired scores on the corresponding main module, thus obviating the need to administer that main module. Conversely, the domain scores from the Screening Module can identify individuals who are fully intact and who are expected to obtain similarly intact/above average scores on the corresponding main module, also obviating the need to administer the main module. Of course, these screening recommendations are merely guidelines for those users who may wish to follow them. Many referral questions and applications of the NAB will no doubt require administration of the entire NAB, and professional clinicians should use their judgment when determining the need for administration of the entire NAB.

The ability of the Screening Domain scores to predict performance on the corresponding module index scores was analyzed. A sample of 1,635 individuals was aggregated from the NAB standardization sample (N = 1,448), and a number of special groups: traumatic brain injury (n = 32), multiple sclerosis (n = 31), adult attention-deficit/hyperactivity disorder (n = 30), human immunodeficiency virus (n = 19), aphasia (n = 23), dementia (n = 13), and inpatient rehabilitation (n = 39). Some groups completed only selected NAB modules. Each of the five module index scores was categorized into one of three groups. The moderately-to-severely impaired and worse index score range was 45-61; the goal was to identify individuals who score in this range and recommend against testing them with the corresponding main NAB module. The moderately impaired to average index score range was 62-106; the goal was to identify individuals who score in this range and recommend testing them with the corresponding main NAB module. Finally, the above average and better index score range was 107-155, the goal was to identify individuals who score in this range and recommend against testing them with the corresponding main NAB module.

For each module, the cumulative score distribution of the Screening Domain score was computed for each of the three module index score ranges. A conservative criterion was selected to identify at least 95% of the individuals who are recommended to receive the full module. This decision was based on the belief that it is more desirable to administer the main module unnecessarily than to screen out an individual who may, in fact, require the main module. The screening recommendation decision accuracy rates are presented in Table 6.7. For the moderately-to-severely impaired cutoff, the criterion of identifying at least 95% of the individuals who are judged to require administration of the corresponding main NAB module was achieved. Only 5% of the individuals who obtained index scores in the 62-106 range (i.e., who are judged to require administration of the main module) were missed by the respective cutoff scores. The moderately-to-severely impaired cutoff scores also correctly identify between 44% and 75% of individuals who obtain index scores in the 45-61 range (i.e., who are judged not to require administration of the main module). These results indicate that the NAB Screening Domain scores have a good ability to predict performance on the main NAB modules at the impaired end of the index score range.

For the above average and higher cutoff, the criterion of identifying at least 95% of the individuals who are judged to require administration of the corresponding main NAB module was achieved. Only 5% of individuals who obtained index scores in the 62-106 range (i.e., who were judged to require administration of the main module) were missed by the respective cutoff scores. The above average and higher cutoff scores correctly identify between 3% and 43% of individuals who obtained index scores in the 107-155 range (i.e., who were judged not to require administration of the main module). These results indicate the above average and higher cutoff scores are not particularly useful for identifying fully intact individuals who are judged not to require administration of the full module. These results are partially attributable to the highly conservative criterion of identifying 95% of individuals who do require main module administration.

EVIDENCE BASED ON RELATIONSHIPS TO OTHER (EXTERNAL) VARIABLES

Relationships Between NAB Screening Module Scores and External Neuropsychological Measures

A subset of nonimpaired individuals (n = 50) who participated in the NAB standardization study also completed a number of concurrent validity measures. The purpose of this study was to compare NAB scores to validated construct measures of specific cognitive functions and to examine both convergent and divergent validity of NAB scores. The 50 participants ranged in age from 20 to 85 years (M = 59.5 years, SD = 17.5 years). The percentages of the sample by education level were 18% with ≤11 years, 24% with 12

Table 6.7
Recommendations for Administering NAB Modules Based on Screening Domain Scores

Screening Domain score range	Sensitivity	Specificity	False-positive rate	False-negative rate	Positive-predictive power	Negative-predictive power	Overall correct classification rate
	Decision accuracy rates						
Screening Attention Domain							
Moderately-to-severely impaired cutoff (≤74)	.95	.59	.41	.05	.99	.16	.95
Above average cutoff (≥114)	.95	.43	.57	.05	.79	.80	.79
Screening Language Domain							
Moderately-to-severely impaired cutoff (≤75)	.95	.75	.25	.05	.99	.17	.95
Above average cutoff (≥126)	.96	.03	.97	.04	.69	.25	.67
Screening Memory Domain							
Moderately-to-severely impaired cutoff (≤75)	.95	.71	.29	.05	.99	.11	.95
Above average cutoff (≥119)	.95	.21	.79	.05	.72	.68	.72
Screening Spatial Domain							
Moderately-to-severely impaired cutoff (≤74)	.95	.44	.56	.05	.99	.05	.95
Above average cutoff (≥120)	.95	.22	.78	.05	.72	.67	.72
Screening Executive Functions Domain							
Moderately-to-severely impaired cutoff (≤73)	.95	.67	.33	.05	.99	.10	.95
Above average cutoff (≥115)	.95	.38	.62	.05	.77	.77	.77

years, 22% with 13 to 15 years, and 36% with ≥16 years. The average level of education was 13.7 years (*SD* = 2.8 years). The sample consisted of 60% female and 40% male participants, with the following race/ethnicity distribution: 86% Caucasian, 8% African American, 2% Hispanic, and 4% Other race/ethnicity. This sample is the basis for the correlations between NAB scores and all of the external criterion measures, with the exception of the Reynolds Intellectual Screening Test (Reynolds & Kamphaus, 2003), for which the NAB standardization sample is the basis.

General Measures of Cognitive Functioning

Correlations for nonimpaired samples. Correlations between the NAB Screening Domain and Total Screening Index scores and measures of general cognitive functioning are presented in Table 6.8. Four measures of cognitive functioning were correlated with the Screening Domain and Total Screening Index scores: (a) the Modified Mini-Mental State Examination (3MS; Teng & Chui, 1987), (b) the Mini-Mental State Examination (MMSE; Folstein et al., 2001), (c) the Total Scale Index of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS; Randolph, 1998), and (d) the RIST (Reynolds & Kamphaus, 2003). Note that the correlations for the 3MS, MMSE, and RBANS are based on the sample of 50 healthy participants who also completed the other concurrent measures. The correlations for the RIST are based on the NAB standardization sample (*N* = 1,448).

The 3MS is a modification of the MMSE and incorporates four additional test items, more graded scoring, and other minor changes. Performance is reported in raw score units and has a possible range of 0-100 points. Performance on the MMSE is also reported in raw score units, with a range of 0-30 points. The RBANS Total Scale Index is a composite of five RBANS indexes (i.e., Immediate Memory Index, Visuospatial/Constructional Index, Language Index, Attention Index, and Delayed Memory Index), and performance is reported in a standard score metric (*M* = 100, *SD* = 15). Performance on the two RIST subtests Guess What (*GWH*) and Odd-Item Out (*OIO*) are reported on a *T*-score metric (*M* = 50, *SD* = 10), and the RIST Index score is scaled on a standard score metric (i.e., *M* = 100, *SD* = 15).

It was expected that the NAB Screening Domain scores would correlate moderately with the external measures of general cognitive functioning and that the Total Screening Index would have the highest correlation with these measures, particularly for the 3MS, MMSE, and RBANS because these concurrent measures tap into a number of heterogeneous cognitive domains. It is important to note that the correlations

Table 6.8
Correlations Between NAB Screening Domain and Total Screening Index Scores and External Measures of General Cognitive Functioning

				Correlations		
Domain/Index score	**Acronym**	***M***	***SD***	3MS Total raw score	MMSE Total raw score	RBANS Total Index
Domain/Index score						
Screening Attention Domain	S-ATT	99.5	18.4	.32	.48	.56
Screening Language Domain	S-LAN	96.9	17.1	.16	.15	.21
Screening Memory Domain	S-MEM	94.7	15.3	.42	.44	.51
Screening Spatial Domain	S-SPT	100.9	14.8	.26	.29	.36
Screening Executive Functions Domain	S-EXE	96.9	14.5	.39	.46	.55
Total Screening Index	S-NAB	96.9	16.8	.46	.55	.65
	M			95.8	28.7	96.4
	SD			3.9	1.4	16.5
	N			50	50	50

Note. 3MS = Modified Mini-Mental Status Examination (Teng & Chui, 1987); MMSE = Mini-Mental State Examination (Folstein, Folstein, & Fanjiang, 2001); RBANS = Repeatable Battery for the Assessment of Neuropsychological Status (Randolph, 1998).

between NAB scores and external variables are based on a sample of 50 participants; thus, they should be interpreted cautiously and not viewed as the definitive representations of the underlying relationships in the overall population. For example, as seen in Table 6.8, the standard deviations of several Screening Domain and Total Screening Index scores are greater than those for the NAB standardization sample (i.e., 15), a pattern suggesting that the obtained correlations between these scores and the external measures may be slightly inflated (i.e., the magnitude of the correlation coefficient is influenced by variability). Conversely, the slightly smaller variability for the Screening Spatial Domain and Screening Executive Functions Domain scores as compared to the standardization standard deviation of 15 suggests that the actual relationships with external variables would be slightly higher. The pattern of relationships, however, provides instructive information as to the construct validity of NAB scores.

Correlations between the Screening Domain scores and the 3MS range from .16 for the Screening Language Domain score to .42 for the Screening Memory Domain score. MMSE and NAB Screening Domain score correlations range from .15 for the Screening Language Domain score to .48 for the Screening Attention Domain score. Similarly, the NAB and RBANS correlations range from .21 for the Screening Language Domain score to .56 for the Screening Attention Domain score. For all of the NAB Screening Domain scores, the Language Domain showed the lowest correlations with the external measures (see Table 6.8). This finding is likely due to (a) content differences between the NAB Screening Language tests and the concurrent measures and (b) the limited variability of NAB language scores in a healthy sample. As expected, the NAB Total Screening Index had the highest correlations with the external measures. In summary, the pattern of relationships with the external variables are all positive, vary in magnitude from the low to high range, and suggest that the NAB Screening Domain and Total Screening Index scores have convergent validity with these measures but also have divergent validity as indicated by the large percentage of unshared variance.

The relationships between overall verbal and nonverbal cognitive functioning and NAB scores were examined to determine the degree to which these constructs overlap or are independent of NAB constructs. To this end, each participant in the NAB standardization sample also completed the RIST (Reynolds & Kamphaus, 2003). The RIST is a brief measure of general intellectual ability (i.e., *g*) which is composed of two subtests, Guess What (*GWH*) and Odd-Item Out (*OIO*). These two subtests are then combined to produce a single composite score, the RIST Index.

GWH requires the examinee to deduce an object from a series of verbal clues. It thus integrates vocabulary and receptive language development with deductive reasoning and general knowledge, all in the verbal domain. Because of this integration, it is a complex task and, thus, a strong measure of *g*, especially in verbal or crystallized form. *OIO* provides a reverse-analogy problem that invokes many of the same fundamental cognitive processes as verbal reasoning but in the nonverbal domain and without the demand or requirement for language or vocabulary. Some items present classification problems that are nonverbal and qualitative, whereas other items require the recognition of spatial relationships among objects or pictures that may be either quantitative or qualitative. This type of task is very complex, involving visual-perceptual skill, nonverbal analogical reasoning, the ability to shift sets between concrete and abstract stimuli, and strong spatial skills. *OIO* is thus a complex task that provides a strong measurement of *g* and is well aligned with fluid ability and nonverbal intelligence. In a sample of adults (n = 31), the RIST Index was found to correlate strongly with WAIS-III Verbal IQ (r = .63), Performance IQ (r = .66), and Full Scale IQ (r = .67) (Reynolds & Kamphaus, 2003). Because all participants were administered both the NAB and the RIST, all demographic characteristics of the NAB-RIST study are identical to those reported for the NAB standardization sample.

Table 6.9 shows the relationships of the NAB Screening Module Domain and Total Screening Index scores with the RIST scores, and Table 6.10 shows the relationships between the NAB Screening Module primary scores and the RIST scores. The correlations between the NAB Screening Module Domain scores and *GWH* are all quite similar and range from .21 for the Screening Attention Domain score to .33 for both the Screening Memory Domain and Screening Executive Functions Domain scores. The correlations between the NAB Screening Module Domain scores and the *OIO* subtest range from .22 for both the Screening Attention Domain score and Screening Language Domain scores to .32 for the Screening Spatial Domain score.

At the index score level, low to moderate correlations between the NAB Total Screening Index and the RIST scores are also observed. The NAB Total Screening Index correlates most strongly with the three RIST scores. It is noteworthy that the NAB Screening Domain and Total Screening Index scores show only a small percentage of shared variance with the RIST Index. The variance shared between the NAB Screening Domain scores and the RIST Index ranges from 6% (Screening Attention Domain score) to 13% (Screening Executive Functions Domain score). There is 22% variance shared between the NAB Total Screening Index and the RIST Index. Overall, these data suggest that the NAB Screening Domain scores and Screening Module primary scores, while showing expected positive relationships with measures of overall or general intellectual ability, are tapping into a high percentage of unique variance that is not accounted for by global intelligence.

For clinicians interested in examining further the relationship between NAB scores and the RIST, Tables B.1 and B.7 in Appendix B provide the descriptive statistics of Screening Module primary, secondary, and descriptive raw scores by five RIST Index score ranges (≤79, 80-89, 90-109, 110-119 and ≥120) for Screening Module Forms 1 and 2, respectively.

Correlations for clinical patient samples. The relationships between the NAB Screening Domain and Total Screening Index scores and general measures of cognitive functioning in a clinical sample were investigated. The data from a study of 20 outpatients with dementia (described in detail in a subsequent section of this chapter) were used for this study. Participants in this study received the NAB Screening and Memory Modules along with the MMSE (Folstein et al., 2001) and the Dementia Rating Scale-2

Table 6.9
Correlations Between NAB Screening Domain and Total Screening Index Scores and the RIST for the Demographically Corrected Standardization Sample

		RIST score		
Domain/Index score	**Acronym**	*GWH*	*OIO*	Index
Screening Attention Domain	S-ATT	.21	.22	.24
Screening Language Domain	S-LAN	.26	.22	.26
Screening Memory Domain	S-MEM	.33	.27	.34
Screening Spatial Domain	S-SPT	.26	.32	.33
Screening Executive Functions Domain	S-EXE	.33	.31	.36
Total Screening Index	S-NAB	.43	.41	.47

Note. N = 1,448. RIST = Reynolds Intelligence Screening Test (Reynolds & Kamphaus, 2003); *GWH* = Guess What; *OIO* = Odd Item Out.

Table 6.10
Correlations Between NAB Screening Module Primary Scores and the RIST for the Demographically Corrected Standardization Sample

Test	Acronym	RIST score *GWH*	*OIO*	Index
Screening Digits Forward	S-DGF	.22	.15	.21
Screening Digits Backward	S-DGB	.26	.23	.28
Screening Numbers & Letters Part A Speed	S-N&L_A–spd	.03	.09	.07
Screening Numbers & Letters Part A Errors	S-N&L_A–err	.15	.09	.13
Screening Numbers & Letters Part A Efficiency	S-N&L_A–eff	.08	.12	.11
Screening Numbers & Letters Part B Efficiency	S-N&L_B–eff	–.01	.08	.04
Screening Auditory Comprehension	S-AUD	.17	.16	.17
Screening Naming	S-NAM	.28	.19	.26
Screening Shape Learning Immediate Recognition	S-SHL–irg	.14	.16	.17
Screening Shape Learning Delayed Recognition	S-SHL–drg	.15	.15	.16
Screening Story Learning Immediate Recall	S-STL–irc	.33	.23	.32
Screening Story Learning Delayed Recall	S-STL–drc	.31	.22	.29
Screening Visual Discrimination	S-VIS	.15	.22	.20
Screening Design Construction	S-DES	.26	.28	.31
Screening Mazes	S-MAZ	.17	.23	.22
Screening Word Generation	S-WGN	.34	.27	.35

Note. *N* = 1,448. RIST = Reynolds Intelligence Screening Test (Reynolds & Kamphaus, 2003); *GWH* = Guess What; *OIO* = Odd Item Out.

(DRS-2; Jurica et al., 2001). As shown in Table 6.11, the NAB Screening Domain scores all have moderate correlations with the MMSE, ranging from .39 for Screening Language Domain and Screening Spatial Domain scores to .54 for the Screening Executive Functions Domain score. The correlations between the Screening Domain scores and the DRS-2 Total scaled score (Total AMSS) are more varied, ranging from –.08 for the Screening Spatial Domain score to .64 for the Screening Executive Functions Domain score. As expected, the Total Screening Index is moderately correlated with both the MMSE (r = .66) and the DRS-2 Total scaled score (r = .54) in this sample of patients with dementia, results providing additional evidence of the criterion validity of the Screening Domain and Total Screening Index scores.

Criterion Measures of Attention

Correlations for a nonimpaired sample. Correlations between the NAB Screening Domain and Total Screening Index scores and four external criterion measures of attention are presented in Table 6.12. Eight tests and one index of the Wechsler Memory Scale, Third Edition (WMS-III; Wechsler, 1997b) were used as external criterion measures of attention: Spatial Span Forward, Spatial Span Backward, Digit Span Forward, Digit Span Backward, Digit Span Total, Letter-Number Sequencing, Mental Control, Working Memory Index, and Information and Orientation. Parts A and B of the Trail Making Test from the Halstead-Reitan Neuropsychological Battery (TMT; Reitan & Wolfson, 1993) and the Digit Span and Coding Subtests from the RBANS (Randolph, 1998) served as criterion attention

Table 6.11
Correlations Between Screening Module Scores and the MMSE and the DRS-2 in the Dementia Sample

					DRS-2 score												
Test/Domain/ Index score	Acronym	*M*	*SD*	MMSE score	Attention raw score	Attention AMSS	Initiation/Perseveration raw score	Initiation/Perseveration AMSS	Construction raw score	Construction AMSS	Conceptualization raw score	Conceptualization AMSS	Memory Raw score	Memory AMSS	Total Raw score	Total AMSS	Age and Education Corrected MOANS scaled score
Primary score																	
Screening Digits Forward	S-DGF	45.9	1.1	.38	.70	.71	.64	.44	.31	.21	.24	.27	.56	.59	.65	.55	.61
Screening Digits Backward	S-DGB	43.8	7.9	.55	.60	.60	.60	.48	.45	.43	.24	.28	.22	.26	.54	.51	.55
Screening Numbers & Letters Part A Speed	S-N&L$_A$–spd	37.8	12.1	.27	.58	.72	.30	.23	.37	.34	.02	.16	.17	.26	.30	.26	.39
Screening Numbers & Letters Part A Errors	S-N&L$_A$–err	48.7	9.9	.49	.15	.04	.52	.40	–.18	–.19	.35	.26	.11	.18	.42	.44	.34
Screening Numbers & Letters Part A Efficiency	S-N&L$_A$–eff	38.1	11.9	.33	.62	.74	.48	.37	.37	.31	.10	.21	.26	.36	.44	.42	.54
Screening Numbers & Letters Part B Efficiency	S-N&L$_B$–eff	39.3	11.0	.22	.56	.58	.15	.05	.51	.49	.28	.33	.60	.47	.41	.24	.28
Screening Auditory Comprehension	S-AUD	43.3	14.6	.44	.00	–.10	.39	.27	.02	.09	.69	.63	–.10	.02	.41	.33	.21
Screening Naming	S-NAM	34.4	12.4	.14	.19	.07	.71	.72	.27	.23	.12	.08	.26	.06	.53	.53	.44
Screening Shape Learning Immediate Recognition	S-SHL–irg	45.3	9.1	.13	–.30	–.33	–.14	–.21	–.21	–.25	–.28	–.31	–.04	.00	–.22	–.30	–.29
Screening Shape Learning Delayed Recognition	S-SHL–drg	49.0	9.6	.17	.07	.11	–.20	–.42	.05	–.01	–.01	.03	–.01	.10	–.11	–.28	–.21
Screening Story Learning Immediate Recall	S-STL–irc	39.1	8.4	.42	.49	.47	.39	.33	.49	.39	.35	.32	.60	.64	.56	.49	.56
Screening Story Learning Delayed Recall	S-STL–drc	29.9	7.7	.31	.57	.62	.16	.29	.04	–.05	–.09	–.10	.67	.68	.29	.44	.55
Screening Visual Discrimination	S-VIS	41.7	14.1	.40	–.06	–.09	.23	.02	.48	.48	–.02	.04	–.27	–.39	.08	–.09	–.09
Screening Design Construction	S-DES	46.6	1.7	.25	.28	.36	.22	.14	.26	.29	.12	.18	–.17	.18	.16	.13	.19
Screening Mazes	S-MAZ	42.4	11.8	.48	.30	.30	.32	.10	.37	.36	.05	.08	.12	.07	.28	.21	.24
Screening Word Generation	S-WGN	41.4	7.7	.44	.60	.56	.63	.69	.36	.35	.28	.26	.40	.58	.62	.71	.69

(continued)

Table 6.11 (continued)
Correlations Between Screening Module Scores and the MMSE and DRS-2 in the Dementia Sample

Test/Domain/ Index score	Acronym	*M*	*SD*	MMSE score	DRS-2 score													
					Attention raw score	Attention AMSS	Initiation/Perseveration raw score	Initiation/Perseveration AMSS	Construction raw score	Construction AMSS	Conceptualization raw score	Conceptualization AMSS	Memory raw score	Memory AMSS	Total raw score	Total AMSS	Age and Education Corrected MOANS scaled score
Domain/Index score																		
Screening Attention Domain	S-ATT	82.2	15.7	.48	.79	.84	.54	.39	.45	.39	.24	.31	.53	.55	.61	.53	.61
Screening Language Domain	S-LAN	81.2	15.1	.39	.07	–.07	.68	.66	.15	.18	.41	.34	.09	.03	.54	.56	.44
Screening Memory Domain	S-MEM	8.3	11.1	.40	.30	.31	.08	–.02	.15	.04	–.02	–.03	.45	.52	.19	.11	.20
Screening Spatial Domain	S-SPT	89.5	16.9	.39	.03	.06	.18	.02	.44	.45	–.02	.06	–.34	–.23	.04	–.08	–.04
Screening Executive Functions Domain	S-EXE	84.9	15.2	.54	.59	.56	.62	.58	.41	.40	.21	.21	.36	.48	.58	.64	.64
Total Screening Index	S-NAB	75.7	13.2	.66	.52	.50	.65	.51	.50	.46	.24	.26	.29	.37	.59	.54	.56
M				23.1	11.4	35.6	27.2	5.8	5.4	8.4	33.1	8.4	3.4	15.8	117.1	4.9	4.1
SD				3.1	2.1	1.3	7.9	3.8	1.1	2.3	4.5	2.8	2.0	3.7	14.4	2.7	3.3
N				19	14	14	14	14	14	14	14	14	14	14	14	14	14

Note. MMSE = Mini-Mental State Examination (Folstein, Folstein, & Fanjiang, 2001); DRS-2 = Dementia Rating Scale-2 (Jurica, Leitten, & Mattis, 2001); AMSS = Age Corrected MOANS Scaled Score; MOANS = Mayo Older American Normative Studies.

Table 6.12
Correlations Between NAB Screening Module Scores and Four Criterion Measures of Attention for a Nonimpaired Sample

Test/Domain/ Index score	Acronym	*M*	*SD*	WMS-III score: Spatial Span Forward	Spatial Span Backward	Digit Span Forward	Digit Span Backward	Digit Span Total	L-N Sequencing	Mental Control	Working Memory Index	Info & Orientation
Primary score[a]												
Screening Digits Forward	S-DGF	49.2	1.8	.18	.26	.57	.49	.64	.51	.08	.47	.21
Screening Digits Backward	S-DGB	49.7	1.3	.29	.39	.52	.55	.64	.55	.17	.54	.07
Screening Numbers & Letters Part A Speed	S-N&L$_A$–spd	50.2	9.8	.23	.16	.18	.21	.16	.28	.24	.27	.16
Screening Numbers & Letters Part A Errors	S-N&L$_A$–err	49.9	1.1	.22	.21	.37	.40	.42	.41	.04	.36	–.11
Screening Numbers & Letters Part A Efficiency	S-N&L$_A$–eff	49.8	1.7	.31	.19	.26	.30	.27	.38	.26	.36	.14
Screening Numbers & Letters Part B Efficiency	S-N&L$_B$–eff	50.3	12.2	.48	.52	.27	.29	.35	.43	.28	.56	.19
Screening Auditory Comprehension	S-AUD	48.8	11.7	.05	.35	.15	.24	.23	.13	.07	.20	.24
Screening Naming	S-NAM	49.0	11.3	.07	.07	.11	.04	.07	.16	.18	.12	.26
Screening Shape Learning Immediate Recognition	S-SHL–irg	48.9	9.5	.13	.33	.20	.27	.26	.34	.31	.36	.21
Screening Shape Learning Delayed Recognition	S-SHL–drg	48.7	1.5	.00	.04	.08	.07	.03	.10	–.02	.10	.05
Screening Story Learning Immediate Recall	S-STL–irc	47.4	11.4	–.16	.30	.29	.17	.27	.30	.15	.24	.02
Screening Story Learning Delayed Recall	S-STL–drc	45.3	1.8	–.10	.25	.45	.24	.39	.38	–.04	.30	.01
Screening Visual Discrimination	S-VIS	51.8	9.8	.20	.08	.20	.23	.31	.29	.19	.28	.37
Screening Design Construction	S-DES	49.3	11.4	.35	.34	.02	.17	.10	.21	.16	.33	.16
Screening Mazes	S-MAZ	48.2	1.0	.31	.32	.39	.49	.49	.40	.33	.43	.33
Screening Word Generation	S-WGN	48.2	9.4	.27	.13	.34	.23	.33	.33	.12	.36	–.04
Secondary score[b]												
Screening Orientation	S-ORN	28.5	.8	.28	.13	.07	.26	.23	.18	.07	.22	.29
Screening Digits Forward Longest Span	S-DGF–spn	6.7	1.3	.25	.26	.57	.55	.62	.55	.18	.50	.37
Screening Digits Backward Longest Span	S-DGB–spn	4.8	1.4	.37	.42	.51	.58	.60	.51	.20	.54	.18
Screening Shape Learning Percent Retention	S-SHL–%rt	82.2	58.3	–.08	–.06	–.04	.03	–.10	.04	–.06	.01	.21
Screening Story Learning Percent Retention	S-STL–%rt	77.7	22.6	.05	.06	.25	.12	.14	.21	–.32	.18	.04
Screening Word Generation Perseverations	S-WGN–psv	.4	.9	.00	.22	.09	.10	.06	–.05	.02	.03	–.05

(continued)

Table 6.12 (continued)
Correlations Between NAB Screening Module Scores and Four Criterion Measures of Attention for a Nonimpaired Sample

Test/Domain/ Index score	Acronym	*M*	*SD*	WMS-III score: Spatial Span Forward	Spatial Span Backward	Digit Span Forward	Digit Span Backward	Digit Span Total	L-N Sequencing	Mental Control	Working Memory Index	Info & Orientation
Descriptive score[b]												
Screening Orientation to Self	S-ORN–slf	13.9	.3	.21	–.02	.09	.08	.15	.22	.15	.20	.07
Screening Orientation to Time	S-ORN–tim	9.8	.5	.01	–.05	–.29	.03	–.12	–.18	–.03	–.13	.14
Screening Orientation to Place	S-ORN–plc	3.8	.5	.28	–.01	–.01	–.11	.02	.03	.10	.12	.08
Screening Orientation to Situation	S-ORN–sit	1.0	.2	–.08	.18	–.02	.21	.07	.06	.18	.08	.47
Screening Auditory Comprehension Colors	S-AUD–col	12.9	.4	–.04	.00	.20	.17	.19	–.07	–.12	–.03	–.05
Screening Auditory Comprehension Shapes	S-AUD–shp	21.7	.8	.08	.24	.16	.15	.19	.08	.25	.12	.16
Screening Auditory Comprehension Colors/ Shapes/Numbers	S-AUD–csn	20.7	.7	.11	.30	.05	.28	.17	.21	.05	.26	.67
Screening Naming Percent Correct After Semantic Cuing	S-NAM–sem%	31.6	39.7	–.10	–.14	.29	.11	.23	.26	.00	.11	–.05
Screening Naming Percent Correct After Phonemic Cuing	S-NAM–pho%	75.9	41.0	.38	.20	.04	.18	.15	.05	–.22	.17	.24
Domain/Index score												
Screening Attention Domain	S-ATT	99.5	18.4	.43	.47	.54	.54	.64	.63	.27	.65	.20
Screening Language Domain	S-LAN	96.9	17.1	.05	.14	.05	.05	.04	.12	.18	.11	.24
Screening Memory Domain	S-MEM	94.7	15.3	–.05	.32	.37	.26	.34	.40	.12	.35	.09
Screening Spatial Domain	S-SPT	100.9	14.8	.39	.33	.14	.25	.25	.35	.25	.44	.31
Screening Executive Functions Domain	S-EXE	96.9	14.5	.34	.31	.47	.45	.53	.48	.28	.50	.21
Total Screening Index	S-NAB	96.9	16.8	.34	.48	.44	.46	.54	.61	.32	.62	.31

(continued)

Table 6.12 (continued)
Correlations Between NAB Screening Module Scores and Four Criterion Measures of Attention for a Nonimpaired Sample

Test/Domain/ Index score	Acronym	TMT score		RBANS score		Ruff 2 & 7 score					
		Trails A	Trails B	Digit Span	Coding	AD Speed	AD Accuracy	CS Speed	CS Accuracy	Total Speed	Total Accuracy
Primary score[a]											
Screening Digits Forward	S-DGF	.19	.49	.61	.18	.16	.19	.18	.20	.20	.21
Screening Digits Backward	S-DGB	.49	.56	.42	.24	.32	.27	.38	.38	.39	.35
Screening Numbers & Letters Part A Speed	S-N&L_A–spd	.33	.30	.31	.50	.49	.10	.57	.25	.56	.19
Screening Numbers & Letters Part A Errors	S-N&L_A–err	.36	.41	.29	.28	.29	.47	.35	.47	.33	.50
Screening Numbers & Letters Part A Efficiency	S-N&L_A–eff	.42	.37	.38	.54	.52	.25	.62	.35	.61	.32
Screening Numbers & Letters Part B Efficiency	S-N&L_B–eff	.33	.26	.42	.39	.21	.21	.29	.29	.26	.27
Screening Auditory Comprehension	S-AUD	.17	.18	.16	.04	–.10	.39	–.13	.34	–.09	.39
Screening Naming	S-NAM	.13	.12	.17	.07	.11	.32	.05	.26	.10	.31
Screening Shape Learning Immediate Recognition	S-SHL–irg	.24	.19	.36	.26	.23	.22	.26	.33	.27	.29
Screening Shape Learning Delayed Recognition	S-SHL–drg	.02	–.04	.02	.01	–.03	.17	–.09	.12	–.02	.14
Screening Story Learning Immediate Recall	S-STL–irc	–.13	.30	.27	.06	.06	.23	.01	.23	.04	.25
Screening Story Learning Delayed Recall	S-STL–drc	–.13	.25	.40	.19	.15	.24	.10	.28	.12	.29
Screening Visual Discrimination	S-VIS	.29	.30	.23	.17	.15	.20	.13	.12	.16	.16
Screening Design Construction	S-DES	.33	.45	.27	.14	.13	.28	.14	.35	.20	.33
Screening Mazes	S-MAZ	.41	.43	.54	.34	.29	.18	.32	.26	.33	.24
Screening Word Generation	S-WGN	.12	.41	.36	.18	.08	.22	.17	.24	.13	.25
Secondary score[b]											
Screening Orientation	S-ORN	.33	.04	.38	.27	.05	.29	.16	.25	.14	.29
Screening Digits Forward Longest Span	S-DGF–spn	.19	.52	.65	.39	.12	.17	.18	.19	.19	.19
Screening Digits Backward Longest Span	S-DGB–spn	.45	.55	.45	.36	.26	.20	.34	.34	.37	.29
Screening Shape Learning Percent Retention	S-SHL–%rt	.02	–.07	–.02	.20	.11	–.07	.07	–.11	.11	–.10
Screening Story Learning Percent Retention	S-STL–%rt	–.02	.02	.15	.28	.11	–.01	.09	.08	.08	.05
Screening Word Generation Perseverations	S-WGN–psv	.00	–.11	.03	.11	.00	–.06	.02	.05	.01	.00

(continued)

Table 6.12 (continued)
Correlations Between NAB Screening Module Scores and Four Criterion Measures of Attention for a Nonimpaired Sample

Test/Domain/Index/score	Acronym	TMT score		RBANS score		Ruff 2 & 7 score					
		Trails A	Trails B	Digit Span	Coding	AD Speed	AD Accuracy	CS Speed	CS Accuracy	Total Speed	Total Accuracy
Descriptive score[b]											
Screening Orientation to Self	S-ORN–slf	.21	.19	.17	.06	.07	.26	.19	.18	.16	.24
Screening Orientation to Time	S-ORN–tim	.11	–.13	.03	–.07	–.17	–.11	–.13	–.11	–.12	–.11
Screening Orientation to Place	S-ORN–plc	.06	–.07	.12	–.11	–.07	.12	–.11	.13	–.07	.13
Screening Orientation to Situation	S-ORN–sit	–.13	–.11	.13	.36	.03	.02	.14	.02	.09	.02
Screening Auditory Comprehension Colors	S-AUD–col	.13	–.05	.18	.14	–.09	–.10	–.06	.18	–.06	.07
Screening Auditory Comprehension Shapes	S-AUD–shp	.06	.09	.22	.06	–.03	.46	–.01	.29	.00	.39
Screening Auditory Comprehension Colors/ Shapes/Numbers	S-AUD–csn	.05	.15	.16	.21	.03	.21	–.01	.16	.02	.19
Screening Naming Percent Correct After Semantic Cuing	S-NAM–sem%	.02	–.08	–.07	.00	–.01	–.09	.01	.10	.00	.02
Screening Naming Percent Correct After Phonemic Cuing	S-NAM–pho%	.19	–.19	.00	.19	–.17	–.17	–.04	.05	–.10	–.05
Domain/Index score											
Screening Attention Domain	S-ATT	.48	.56	.63	.46	.40	.31	.49	.41	.49	.38
Screening Language Domain	S-LAN	.21	.18	.12	.03	–.03	.40	–.05	.38	–.02	.42
Screening Memory Domain	S-MEM	–.02	.25	.38	.18	.14	.29	.09	.33	.14	.33
Screening Spatial Domain	S-SPT	.45	.53	.33	.19	.18	.35	.18	.35	.25	.37
Screening Executive Functions Domain	S-EXE	.31	.51	.58	.31	.21	.23	.27	.31	.26	.29
Total Screening Index	S-NAB	.43	.61	.61	.35	.26	.47	.29	.54	.34	.54

Note. N = 50. WMS-III = Wechsler Memory Scale–Third Edition (Wechsler, 1997b); TMT = Trail Making Test (Reitan & Wolfson, 1993); RBANS = Repeatable Battery of the Assessment of Neuropsychology Status (Randolph, 1998); Ruff 2 & 7 = Ruff 2 & 7 Selective Attention Test (Ruff & Allen, 1996); L-N = Letter Number; A-D Automatic Detection; CS = Controlled Search. Means and standard deviations for primary scores are T-score metric; means and standard deviations for secondary and descriptive are z score metric.

[a] T scores were used to calculate correlations. [b] z scores were used to calculate correlations.

measures. Finally, the following six scores from the Ruff 2&7 Selective Attention Test (Ruff 2&7; Ruff & Allen, 1996) served as criterion attention measures: Automatic Detection Speed (AD Speed), Automatic Detection Accuracy (AD Accuracy), Controlled Search Speed (CS Speed), Controlled Search Accuracy (CS Accuracy), Total Speed, and Total Accuracy. With the exception of the Information and Orientation subtest of the WMS-III for which performance is reported in raw score units, performance on the other WMS-III subtests is reported in scaled scores units (M = 10, SD = 3). The Working Memory Index is scaled to a standard score metric (M = 100, SD = 15). Performance on the TMT Parts A and B is reported in raw scores units (time to complete in seconds), and performance on both RBANS measures is reported in raw score units. Performance on the Ruff 2&7 measures are reported in T scores (M = 50, SD = 10).

It was anticipated that there would be a general trend of higher correlations between the Screening Attention Domain score relative to the other Screening Domain scores and that NAB Screening Attention tests would correlate highly with other external measures of attention. With only three exceptions, the Screening Attention Domain score shows higher correlations with the external attention measures than the other Screening Domain scores. The Mental Control subtest of the WMS-III has a similar correlation with the Screening Attention and Screening Executive Functions Domain scores, a finding that is not surprising because the Mental Control test requires both attentional processes and higher level working-memory/executive processes. The Screening Digits Forward (S-DGF) and Screening Digits Backward (S-DGB) scores show expected relationships with the Digit Span Forward subtest of the WMS-III and RBANS. The WMS-III Spatial Span subtest tends to correlate more highly with the NAB Screening Module primary scores that contain more visuospatial content (e.g., Screening Visual Discrimination, Screening Design Construction, Screening Numbers & Letters) as compared to other Screening Module tests that do not involve spatial stimuli. The Screening Module primary scores that involve speeded performance (e.g., S-N&L_A–spd) generally correlate more highly with the Ruff 2&7 speed measures than with the Ruff 2&7 accuracy measures. In addition, Screening Module tests that involve the visual modality correlate more highly with criterion attention measures that also involve the visual modality.

Correlations for a clinical sample. The relationships between the NAB Screening Domain score, Total Screening Index score, and Screening Module primary scores for the attention tests (Screening Digits Forward, Screening Digits Backward, Screening Numbers & Letters) with an external criterion measure of attention for a clinical sample were investigated. The data from the study of outpatients with dementia (described in greater detail later in this chapter) were used for this study. Specifically, the relationships between the NAB scores and the DRS-2 Attention scaled score were examined (see Table 6.13). As expected, of all the NAB Screening Domain scores, the Screening Attention Domain score correlated most highly with the DRS-2 Attention T score (r = .84). The correlations between the remaining Screening Domain scores and the DRS-2 Attention score were varied and much lower. The correlation between the Total Screening Index and the DRS-2 Attention T score was .50. These data further support the convergent and divergent validity of the NAB Screening Module summary scores.

The correlations between the scores on the NAB Screening Module Attention primary tests and the DRS-2 Attention score also provide support for the criterion validity of the NAB measures. As shown in Table 6.13, most correlations are positive, and most are in the expected magnitude and direction.

Criterion Measures of Language

Correlations for a nonimpaired sample. Correlations between NAB Screening Module language tests and external criterion measures of language are presented in the Table 6.14. A diverse set of criterion language measures were included in the study: (a) the Boston Naming Test (BNT; Kaplan et al., 1983), (b) the Token Test from the Multilingual Aphasia Examination (TT; Benton, Hamsher et al., 1994), (c) the Controlled Oral Word Association Test of the Multilingual Aphasia Examination (FAS; Benton, Hamsher et al., 1994), (d) the animal naming portion of the Category Naming Test (Animal Naming; Morris et al., 1989), and (e) language tests from the RBANS.

The Screening Naming (S-NAM) primary score shows relatively higher correlations with the BNT and the Picture Naming subtest of the RBANS than with other language measures. Also, lower but consistent correlations are seen between the external naming measures and Screening Visual Discrimination (S-VIS), a finding that is not surprising given the visual presentation of confrontational naming. The reduced variability in both the TT total score and the Screening Auditory Comprehension (S-AUD) primary score (i.e., most healthy adults obtain near perfect scores) likely cause the very low correlation coefficient. The Screening Word Generation (S-WGN) primary score correlates most highly with the FAS total score. An examination of the correlation patterns with the NAB Screening Module tests of attention, memory, spatial, and executive functions also shows moderate relationships for some scores. Given the

Table 6.13
Correlations Between NAB Screening Module Scores and the DRS-2 Attention Scores in the Dementia Sample

Test/Domain/Index score	Acronym	*M*	*SD*	DRS-2 score: Attention raw score	DRS-2 score: Attention age-corrected scaled score
Primary score					
Screening Digits Forward	S-DGF	45.9	10.1	.70	.71
Screening Digits Backward	S-DGB	43.8	7.9	.60	.60
Screening Numbers & Letters Part A Speed	S-N&L$_A$–spd	37.8	12.1	.58	.72
Screening Numbers & Letters Part A Errors	S-N&L$_A$–err	48.7	9.9	.15	.04
Screening Numbers & Letters Part A Efficiency	S-N&L$_A$–eff	38.1	11.9	.62	.74
Screening Numbers & Letters Part B Efficiency	S-N&L$_B$–eff	39.3	11.0	.56	.58
Screening Auditory Comprehension	S-AUD	43.3	14.6	.00	–.10
Screening Naming	S-NAM	34.4	12.4	.19	.07
Screening Shape Learning Immediate Recognition	S-SHL–irg	45.3	9.1	–.30	–.33
Screening Shape Learning Delayed Recognition	S-SHL–drg	49.0	9.6	.07	.11
Screening Story Learning Immediate Recall	S-STL–irc	39.1	8.4	.49	.47
Screening Story Learning Delayed Recall	S-STL–drc	29.9	7.7	.57	.62
Screening Visual Discrimination	S-VIS	41.7	14.1	–.06	–.09
Screening Design Construction	S-DES	46.6	10.7	.28	.36
Screening Mazes	S-MAZ	42.4	11.8	.30	.30
Screening Word Generation	S-WGN	41.4	7.7	.60	.56
Domain/Index score					
Screening Attention Domain	S-ATT	82.2	15.7	.79	.84
Screening Language Domain	S-LAN	81.2	15.1	.07	–.07
Screening Memory Domain	S-MEM	80.3	11.1	.30	.31
Screening Spatial Domain	S-SPT	89.5	16.9	.03	.06
Screening Executive Functions Domain	S-EXE	84.9	15.2	.59	.56
Total Screening Index	S-NAB	75.7	13.2	.52	.50
	M			11.4	35.6
	SD			2.1	1.3
	N			14	14

Note. DRS-2 = Dementia Rating Scale-2 (Jurica, Leitten, & Mattis, 2001).

complex nature for several of these external measures, it is not surprising that there is moderate overlap in other domains of neuropsychological functioning.

Correlations for a clinical patient sample. The relationships between the NAB Screening Domain scores, the Total Screening Index score, and the Screening Module primary scores for the language tests (Screening Naming, Screening Auditory Comprehension) and external criterion measures of language for a clinical sample were investigated. The data from a study of outpatients diagnosed with aphasia (described in detail in a subsequent section in this chapter) were used for this study. Specifically, the relationships between the NAB scores and the Boston Naming Test (BNT; Kaplan et al., 1983) and the Token Test (Benton, Hamsher et al., 1994) were examined (see Table 6.15). As expected, of all the NAB Screening Domain scores, the Screening Language Domain score correlated most highly with the BNT (r = .78), with the correlations between the BNT and other Screening Domain scores lower and variable (Screening Attention Domain score, r = .38; Screening Memory Domain score, r = .60; Screening Spatial Domain score, r = .26; Screening Executive Functions Domain score,

Table 6.14
Correlations Between NAB Screening Module Scores and Four Criterion Measures of Language for a Nonimpaired Sample

Test/Domain/ Index score	Acronym	BNT score			TT score	Verbal Fluency score		RBANS score		
		Correct without cues	Correct with semantic cues	Correct with phonemic cues	Total score	FAS total score	Animal total score	Picture Naming	Semantic Fluency	Language index
Primary score[a]										
Screening Digits Forward	S-DGF	.14	.21	.29	.35	.40	.14	.26	.24	.30
Screening Digits Backward	S-DGB	.19	.21	.22	.26	.43	.17	.00	.20	.13
Screening Numbers & Letters Part A Speed	S-N&L_A–spd	.04	.12	.18	.29	–.01	.20	.05	.16	.20
Screening Numbers & Letters Part A Errors	S-N&L_A–err	.14	.18	.13	–.12	.11	.11	–.16	.30	.14
Screening Numbers & Letters Part A Efficiency	S-N&L_A–eff	.12	.20	.21	.23	.05	.24	.03	.26	.25
Screening Numbers & Letters Part B Efficiency	S-N&L_B–eff	.08	.19	.10	.22	.07	.24	.07	.15	.19
Screening Auditory Comprehension	S-AUD	.24	.33	.29	.07	–.03	.10	.40	.03	.23
Screening Naming	S-NAM	.40	.47	.44	.07	.18	.24	.38	.08	.18
Screening Shape Learning Immediate Recognition	S-SHL–irg	.26	.19	.23	.37	.35	.25	.24	.18	.23
Screening Shape Learning Delayed Recognition	S-SHL–drg	.19	.07	.10	.01	.19	.02	.07	–.11	–.08
Screening Story Learning Immediate Recall	S-STL–irc	.04	.12	.14	–.07	.28	.02	.21	.23	.26
Screening Story Learning Delayed Recall	S-STL–drc	.07	.20	.23	–.11	.23	.16	.29	.18	.23
Screening Visual Discrimination	S-VIS	.27	.35	.36	.10	.18	.26	.20	.36	.46
Screening Design Construction	S-DES	.08	.07	.04	.28	–.04	.04	.11	.08	.15
Screening Mazes	S-MAZ	.21	.29	.24	.38	.26	.17	.13	.31	.28
Screening Word Generation	S-WGN	.19	.26	.29	.23	.47	.12	.32	.19	.26
Secondary score[b]										
Screening Orientation	S-ORN	.21	.27	.12	–.04	.12	–.04	.06	.23	.26
Screening Digits Forward Longest Span	S-DGF–spn	.23	.29	.37	.40	.36	.23	.31	.36	.42
Screening Digits Backward Longest Span	S-DGB–spn	.25	.27	.31	.24	.39	.23	.00	.26	.15
Screening Shape Learning Percent Retention	S-SHL–%rt	.23	.11	.08	.14	.05	.00	.07	–.03	.01
Screening Story Learning Percent Retention	S-STL–%rt	.03	.09	.11	–.08	–.13	.17	.03	.06	.04
Screening Word Generation Perseverations	S-WGN–psv	–.09	–.10	–.10	–.11	–.04	.01	.07	–.05	–.12

(continued)

Table 6.14 (continued)
Correlations Between NAB Screening Module Scores and Four Criterion Measures of Language for a Nonimpaired Sample

Test/Domain/ Index score	Acronym	BNT score			TT score	Verbal Fluency score		RBANS score		
		Correct without cues	Correct with semantic cues	Correct with phonemic cues	Total score	FAS total score	Animal total score	Picture Naming	Semantic Fluency	Language
Descriptive score[b]										
Screening Orientation to Self	S-ORN–slf	.21	.26	.13	.02	.24	.18	–.05	.30	.29
Screening Orientation to Time	S-ORN–tim	.02	.09	.02	.00	.03	–.21	–.03	–.03	–.02
Screening Orientation to Place	S-ORN–plc	–.01	.06	.01	.06	.24	.11	–.03	–.11	–.02
Screening Orientation to Situation	S-ORN–sit	.32	.35	.33	–.04	–.15	.18	.43	.33	.48
Screening Auditory Comprehension Colors	S-AUD–col	–.01	.02	–.01	–.03	–.08	–.10	–.06	.03	–.13
Screening Auditory Comprehension Shapes	S-AUD–shp	.21	.27	.27	.09	.08	.17	.58	–.07	.28
Screening Auditory Comprehension Colors/Shapes/Numbers	S-AUD–csn	.43	.47	.41	–.04	–.10	.12	.49	.19	.43
Screening Naming Percent Correct After Semantic Cuing	S-NAM–sem%	.01	.03	.07	–.32	.32	–.03	.00	–.09	–.19
Screening Naming Percent Correct After Phonemic Cuing	S-NAM–pho%	.05	.12	.01	–.26	–.43	.08	–.22	.00	–.10
Domain/Index score										
Screening Attention Domain	S-ATT	.17	.27	.27	.36	.31	.27	.13	.29	.30
Screening Language Domain	S-LAN	.33	.41	.36	.09	.07	.17	.39	.08	.24
Screening Memory Domain	S-MEM	.18	.20	.24	.05	.37	.15	.29	.17	.22
Screening Spatial Domain	S-SPT	.22	.27	.25	.25	.09	.19	.19	.25	.37
Screening Executive Functions Domain	S-EXE	.25	.34	.33	.39	.45	.20	.29	.32	.34
Total Screening Index	S-NAB	.34	.45	.44	.32	.39	.30	.37	.33	.42

Note. $N = 50$. BNT = BNT = Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1983); TT = Token Test (Benton, Hamsher, & Sivan, 1994); FAS = FAS Score of the Multilingual Aphasia Examination (Benton, Hamsher, & Sivan, 1994); RBANS = Repeatable Battery of the Assessment of Neuropsychology Status (Randolph, 1998).

[a] *T* scores were used to calculate correlations. [b] *z* scores were used to calculate correlations.

Table 6.15
Correlations Between NAB Screening Module Scores and the Boston Naming Test (BNT) and Token Test (TT) Scores in the Aphasia Sample

Test/Domain/Index score	Acronym	*M*	*SD*	BNT score	TT score
Primary score					
Screening Digits Forward	S-DGF	30.9	13.2	.62	.72
Screening Digits Backward	S-DGB	32.0	11.3	.60	.75
Screening Numbers & Letters Part A Speed	S-N&L_A–spd	29.4	10.3	.21	.32
Screening Numbers & Letters Part A Errors	S-N&L_A–err	44.4	14.0	–.05	.16
Screening Numbers & Letters Part A Efficiency	S-N&L_A–eff	29.4	9.2	.18	.29
Screening Numbers & Letters Part B Efficiency	S-N&L_B–eff	29.9	12.8	–.54	–.42
Screening Auditory Comprehension	S-AUD	26.6	14.3	.50	.56
Screening Naming	S-NAM	31.1	17.1	.77	.59
Screening Shape Learning Immediate Recognition	S-SHL–irg	51.1	9.4	.22	.21
Screening Shape Learning Delayed Recognition	S-SHL–drg	49.4	9.5	–.27	.02
Screening Story Learning Immediate Recall	S-STL–irc	32.4	15.0	.71	.73
Screening Story Learning Delayed Recall	S-STL–drc	34.5	11.6	.74	.77
Screening Visual Discrimination	S-VIS	49.5	10.7	.27	.01
Screening Design Construction	S-DES	40.5	9.6	–.04	–.06
Screening Mazes	S-MAZ	34.5	11.5	–.29	–.18
Screening Word Generation	S-WGN	34.7	9.1	.49	.40
Domain/Index score					
Screening Attention Domain	S-ATT	61.5	15.3	.38	.50
Screening Language Domain	S-LAN	61.7	24.9	.78	.67
Screening Memory Domain	S-MEM	83.1	16.7	.60	.69
Screening Spatial Domain	S-SPT	90.9	11.6	.26	.07
Screening Executive Functions Domain	S-EXE	70.4	12.4	–.03	.02
Total Screening Index	S-NAB	63.4	10.7	.70	.74
	M			34.7	24.5
	SD			18.7	14.2
	N			21	20

Note. BNT = Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1983); TT = Token Test (Benton, Hamsher, & Sivan, 1994).

r = –.03). The correlations with the Token Test indicated similar relationships with the Screening Language Domain score and the Screening Memory Domain score (r = .67 and r = .69, respectively), a finding that is not unexpected given the need for intact auditory comprehension to perform well on the Screening Story Learning test. The remaining correlations with the Token Test were lower and variable (Screening Attention Domain score, r = .50; Screening Spatial Domain score, r = .07; Screening Executive Functions Domain score, r = .02). The correlations between the Total Screening Index and the two external criterion measures were positive and high (BNT, r = .70; TT, r = .74). The correlations between the scores on the NAB Screening Module language tests and the two criterion language measures also provide support for the criterion validity of the NAB measures. The correlation between the Screening Naming (S-NAM) score and the BNT was .77 and between the Screening Auditory Comprehension (S-AUD) score and the TT was .56.

Criterion Measures of Memory

Correlations for a nonimpaired sample. The external criterion measures of memory consisted of a variety of subtests from three instruments: (a) the WMS-III (Wechsler, 1997b), (b) the California Verbal Learning Test, Second Edition (CVLT-II; Delis et al, 2000), and (c) the RBANS (Randolph, 1998). The four subtests from the WMS-III were Logical Memory I (immediate free recall trial), Logical Memory II (delayed free recall trial), Visual Reproduction I (immediate free recall trial), and Visual Reproduction II (delayed free recall trial). All of the WMS-III measures are scaled scores (M = 10, SD = 3). The CVLT-II measures included (a) Trials 1-5 Total Score, (b) Semantic Clustering, (c) Short Delay Free Recall, (d) Long Delay Free Recall, (e) Total Recognition Discriminability, (f) Total Repetitions, (g) Total Recognition Discrimination vs. Long Delayed Discrimination, and (h) Total Intrusions. The CVLT-II Trials 1-5 Total Score is scaled on a T-score metric (M = 50, SD = 10), the Total Recognition Discrimination vs. Long Delayed Discrimination is reported as a percentage score, and all other CVLT-II measures are z scores (M = 0, SD = 1). The RBANS measures included (a) List Learning Total Score, (b) Story Memory Total Score, (c) Immediate Memory Index, and (d) Delayed Memory Index. On the RBANS, the two total scores are reported in raw score units, and the Immediate Memory Index and Delayed Memory Index are standard scores (M = 100, SD = 15).

Table 6.16 presents the correlations between NAB Screening Module scores and the criterion measures of memory. The NAB Screening Story Learning measures show moderate to high correlations with the external criterion measures of verbal memory and generally show relatively lower correlations with the criterion visual memory measures. The pattern is also generally consistent with that between NAB Screening tests with visual stimuli and external measures with visual stimuli. For example, NAB Screening Story Learning Immediate Recall (S-STL–irc) correlates .32 with WMS-III Logical Memory I and –.12 with WMS-III Visual Reproduction I Recall Total. Conversely, the trend is not as strong for the correlations between NAB Screening Shape Learning Immediate Recognition (S-SHL–irg) and WMS-III Logical Memory I Recall Total (.22) and WMS-III Visual Reproduction I Recall Total (.25), likely reflecting some level of verbal mediation for visually presented tasks. In many cases, the NAB Screening Memory Domain score correlates more highly with the external memory measures than the other NAB Screening Module Domain scores. Not surprisingly, strong correlations are observed between the external memory measures and the NAB Screening Attention Domain and Screening Executive Functions Domain scores.

Correlations for a clinical patient sample. Additional evidence for the criterion validity of the Screening Module memory scores is provided by the results of two studies with clinical samples. The first study involved the sample of 20 patients with dementia (described in detail in a subsequent section of this chapter). The criterion memory measure for the dementia sample was the DRS-2 Memory scaled score. The Screening Memory Domain score correlated positively and moderately with the DRS-2 Memory score (r = .45). However, the Screening Attention Domain score was more highly correlated with the DRS-2 Memory score (r = .53), a relationship possibly reflecting the inclusion of orientation items in the DRS-2 Memory scale. The correlations between the remaining NAB Screening Domain scores and the DRS-2 Memory score were lower (Screening Language Domain score, r = .09; Screening Spatial Domain score, r = –.34; Screening Executive Functions Domain score, r = .36).

The correlations between the NAB Screening Module memory tests (Screening Shape Learning and Screening Story Learning) and the DRS-2 Memory score were mixed. Although the correlations between the two Screening Story Learning scores (Screening Story Learning Immediate Recall and Screening Story Learning Delayed Recall) and the DRS-2 score were positive and high (r = .60 and r =.67, respectively), the correlations with the two Screening Shape Learning scores (Screening Shape Learning Immediate Recognition and Screening Shape Learning Delayed Recognition) were negative and low (r = –.04 and r = –.01, respectively), likely due to the greater emphasis on verbal learning and memory in the DRS-2 Memory scale.

The second study (described in detail in a subsequent section in this chapter) involved a group of 37 inpatients in a rehabilitation hospital who were administered the NAB Screening Module along with the Functional Independence Measure (FIM; Granger et al., 1986), a measure of functional independence widely used in nursing and rehabilitation facilities. The FIM includes a Memory score reflecting memory functioning in everyday life. Higher FIM scores reflect better functioning. In addition to the FIM, the participants were rated by their Registered Nurses (RN), Physical Therapists (PT), and Occupational Therapists (OT) on a 5-point scale with regard to their memory functioning, with a rating of 1 indicating *never or almost never has a problem*, and 5 indicating *always or almost always has a problem*" Thus, lower therapist ratings reflect better functioning, and this "reversed" scale accounts for the negative correlations with NAB scores. Although Table 6.17 presents all correlations, the FIM memory scores and the Occupational Therapists (OT) ratings are the criterion measures of most interest. OT ratings are viewed as more valid and reliable than RN and PT ratings by virtue of OTs' more extensive training in cognitive issues. The correlation between the Screening Memory Domain score and the FIM Memory item was .54, and was higher than the correlations between the FIM Memory item and the other Screening Domain scores (Screening Attention Domain score, r = .10; Screening Language Domain score, r = .33; Screening Spatial Domain

Table 6.16
Correlations Between NAB Screening Module Scores and Criterion Measures of Memory for a Nonimpaired Sample

Test/Domain/ Index score	Acronym	WMS-III score				CVLT-II score								RBANS score			
		Logical Memory I: Recall Total Score	Logical Memory II: Recall Total Score	Visual Reproduction I: Recall Total Score	Visual Reproduction II: Recall Total Score	Trials 1-5 Total Score	Semantic Clustering	Short Delay Free Recall	Long Delay Free Recall	Total Recognition Discriminability	Total Recognition Discrimination vs. Long Delayed Discrimination	Total Repetitions	Total Intrusions	List Learning Total Score	Story Memory Total Score	Immediate Memory Index	Delayed Memory Index
Primary score[a]																	
Screening Digits Forward	S-DGF	.35	.25	.03	.28	.36	.24	.38	.40	.32	–.31	–.23	–.20	.20	.38	.36	.35
Screening Digits Backward	S-DGB	.19	.11	.12	.30	.26	.19	.14	.31	.26	–.30	.04	–.16	.05	.25	.17	.10
Screening Numbers & Letters Part A Speed	S-N&L$_A$–spd	.10	.14	.26	.39	.28	.12	.38	.34	.23	–.28	–.11	–.33	.29	.29	.16	.13
Screening Numbers & Letters Part A Errors	S-N&L$_A$–err	–.04	.06	.14	.24	–.01	.05	–.03	.10	.22	.01	–.02	–.16	–.05	.14	.02	–.01
Screening Numbers & Letters Part A Efficiency	S-N&L$_A$–eff	.10	.16	.26	.43	.25	.13	.36	.36	.29	–.31	–.15	–.38	.24	.28	.13	.12
Screening Numbers & Letters Part B Efficiency	S-N&L$_B$–eff	.33	.36	.30	.47	.33	.24	.39	.35	.33	–.23	–.12	–.39	.26	.25	.29	.20
Screening Auditory Comprehension	S-AUD	.16	.15	.13	.26	.29	.09	.31	.22	.14	–.27	.06	–.35	.15	.13	.17	.23
Screening Naming	S-NAM	.04	.02	–.04	.28	.48	.22	.42	.40	.29	–.29	.08	–.23	.19	.17	.17	.28
Screening Shape Learning Immediate Recognition	S-SHL–irg	.22	.17	.25	.35	.49	.33	.32	.46	.29	–.09	.02	–.23	.32	.40	.40	.34
Screening Shape Learning Delayed Recognition	S-SHL–drg	–.04	.00	.30	.16	.18	.20	.13	.25	.17	–.12	.03	.05	.01	.14	.12	.14
Screening Story Learning Immediate Recall	S-STL–irc	.32	.16	–.12	.04	.31	.13	.10	.17	.22	.01	.14	–.11	.30	.36	.41	.35
Screening Story Learning Delayed Recall	S-STL–drc	.39	.30	–.14	.14	.38	.29	.26	.24	.27	.02	.07	–.15	.45	.49	.55	.53
Screening Visual Discrimination	S-VIS	.25	.17	.08	–.05	.18	.17	.18	.21	.13	–.11	–.15	–.28	.04	.12	.09	.08
Screening Design Construction	S-DES	–.02	.08	.15	.28	.24	.03	.26	.27	.26	.01	.08	–.13	.08	.18	.12	.11
Screening Mazes	S-MAZ	.12	.07	.36	.39	.26	.14	.26	.33	.40	–.24	–.17	–.29	.10	.23	.15	.19
Screening Word Generation	S-WGN	.19	.24	.13	.33	.41	.35	.40	.33	.27	–.15	–.04	–.10	.34	.38	.45	.39
Secondary score[b]																	
Screening Orientation	S-ORN	.19	.15	.16	.18	–.03	–.01	.08	.02	.16	–.14	–.27	–.52	.02	–.04	–.05	.07
Screening Digits Forward Longest Span	S-DGF–spn	.38	.33	–.01	.26	.38	.23	.37	.34	.33	–.26	–.19	–.32	.33	.50	.40	.42
Screening Digits Backward Longest Span	S-DGB–spn	.20	.17	.17	.37	.40	.30	.30	.42	.42	–.32	.05	–.24	.23	.31	.26	.29
Screening Shape Learning Percent Retention	S-SHL–%rt	–.10	–.12	.16	.07	–.08	.00	–.08	.02	.11	–.07	.00	.00	.11	.14	.05	.13

(continued)

Table 6.16 (continued)
Correlations Between NAB Screening Module Scores and Criterion Measures of Memory for a Nonimpaired Sample

Test/Domain/ Index score	Acronym	WMS-III score				CVLT-II score								RBANS score			
		Logical Memory I: Recall Total Score	Logical Memory II: Recall Total Score	Visual Reproduction I: Recall Total Score	Visual Reproduction II: Recall Total Score	Trials 1-5 Total Score	Semantic Clustering	Short Delay Free Recall	Long Delay Free Recall	Total Recognition Discriminability	Total Recognition Discrimination vs. Long Delayed Discrimination	Total Repetitions	Total Intrusions	List Learning Total Score	Story Memory Total Score	Immediate Memory Index	Delayed Memory Index
Screening Story Learning Percent Retention	S-STL–%rt	.13	.17	–.21	.14	.20	.33	.35	.25	.24	–.10	–.13	–.08	.43	.33	.35	.55
Screening Word Generation Perseverations	S-WGN–psv	–.09	–.02	.06	.07	.11	.05	.02	.06	.09	–.10	.07	.09	.08	–.08	–.01	–.01
Descriptive score[b]																	
Screening Orientation to Self	S-ORN–slf	.18	.16	.11	.01	.00	.06	.11	.13	.11	–.30	–.18	–.31	–.10	.05	–.03	.02
Screening Orientation to Time	S-ORN–tim	.02	–.05	.11	.06	–.18	–.15	–.06	–.16	–.08	–.11	–.25	–.24	.02	–.14	–.07	–.07
Screening Orientation to Place	S-ORN–plc	.25	.22	.12	–.11	.22	.14	.25	.16	.20	–.04	–.22	–.13	.00	.10	.09	.05
Screening Orientation to Situation	S-ORN–sit	.19	.20	.09	.10	.21	.13	.17	.15	.26	.05	.06	–.39	.43	.05	.22	.27
Screening Auditory Comprehension Colors	S-AUD–col	–.09	–.16	.04	.20	–.19	–.07	–.13	–.25	–.07	.12	–.10	.07	.10	–.10	–.10	.10
Screening Auditory Comprehension Shapes	S-AUD–shp	.18	.27	.12	.24	.41	.12	.40	.32	.11	–.17	.15	–.36	.12	.18	.18	.19
Screening Auditory Comprehension Colors/Shapes/Numbers	S-AUD–csn	.30	.29	.10	.02	.31	.16	.32	.24	.30	–.50	.03	–.55	.32	.17	.26	.34
Screening Naming Percent Correct After Semantic Cuing	S-NAM–sem%	.06	–.06	–.23	–.35	.05	.14	–.30	–.24	–.08	.28	.25	.08	.17	.23	.22	.08
Screening Naming Percent Correct After Phonemic Cuing	S-NAM–pho%	.23	.29	.21	–.04	–.29	–.13	.01	–.22	.10	–.01	–.04	–.35	.14	.06	.09	.16
Screening Domain score																	
Screening Attention Domain	S-ATT	.34	.31	.25	.51	.41	.27	.44	.48	.40	–.38	–.15	–.39	.26	.39	.33	.27
Screening Language Domain	S-LAN	.11	.05	.00	.27	.39	.13	.39	.29	.19	–.32	.08	–.34	.20	.18	.17	.26
Screening Memory Domain	S-MEM	.33	.23	.08	.24	.47	.33	.28	.38	.34	–.07	.09	–.15	.39	.49	.53	.49
Screening Spatial Domain	S-SPT	.13	.16	.17	.17	.29	.14	.30	.33	.26	–.05	–.02	–.25	.05	.21	.14	.11
Screening Executive Functions Domain	S-EXE	.24	.22	.31	.44	.44	.34	.41	.41	.40	–.24	–.14	–.26	.27	.42	.41	.38
Total Screening Index	S-NAB	.37	.29	.23	.51	.61	.38	.55	.57	.48	–.34	–.06	–.42	.36	.52	.48	.45

Note. N = 50. WMS-III = Wechsler Memory Scale–Third Edition (Wechsler, 1997b); CVLT-II = California Verbal Learning Test (Delis, Kramer, Kaplan, & Ober, 2000); RBANS = Repeatable Battery of the Assessment of Neuropsychology Status (Randolph, 1998).

[a] T scores were used to calculate correlations. [b] z scores were used to calculate correlations.

Table 6.17
Correlations Between NAB Screening Module Scores and Rehabilitation Measures in an Inpatient Rehabilitation Sample

Test/Domain/Index score	Acronym	*M*	*SD*	Registered Nurse ratings[a]		Physical Therapist ratings[a]		Occupational Therapist ratings[a]		FIM midtreatment			
				Attention/ Concentration	Memory	Attention/ Concentration	Memory	Attention/ Concentration	Memory	Social Interaction Item	Memory Item	Problem Solving Item	Total
Primary score													
Screening Digits Forward	S-DGF	43.7	8.5	.27	.12	.13	.06	–.06	.19	–.36	–.14	–.23	–.05
Screening Digits Backward	S-DGB	39.7	8.1	.07	–.09	.05	–.05	–.16	.05	.03	.04	.09	–.01
Screening Numbers & Letters Part A Speed	S-N&L_A–spd	30.9	8.1	–.36	–.22	–.02	–.25	.01	–.07	.06	–.08	–.05	–.25
Screening Numbers & Letters Part A Errors	S-N&L_A–err	41.1	15.1	–.20	–.24	–.26	–.30	–.14	.03	.36	.25	.26	.28
Screening Numbers & Letters Part A Efficiency	S-N&L_A–eff	29.0	7.7	–.51	–.37	–.41	–.41	–.15	–.04	.38	.25	.24	.07
Screening Numbers & Letters Part B Efficiency	S-N&L_B–eff	32.2	7.4	–.29	–.11	–.28	–.28	–.14	–.01	.07	.16	.17	–.11
Screening Auditory Comprehension	S-AUD	45.8	13.6	.03	–.15	–.06	–.43	–.42	–.17	.06	.38	.38	.09
Screening Naming	S-NAM	43.9	13.4	–.18	–.24	–.41	–.40	–.47	–.28	.32	.28	.43	.03
Screening Shape Learning Immediate Recognition	S-SHL–irg	46.6	11.6	.15	.18	.04	–.05	–.08	–.25	.00	.24	.02	.10
Screening Shape Learning Delayed Recognition	S-SHL–drg	46.3	9.9	–.14	.00	–.18	–.17	–.27	–.19	.11	.41	.26	–.01
Screening Story Learning Immediate Recall	S-STL–irc	46.8	10.2	–.07	–.18	.14	.08	–.18	–.31	–.02	.37	.29	–.19
Screening Story Learning Delayed Recall	S-STL–drc	40.8	11.2	–.28	–.46	–.22	–.33	–.50	–.58	.33	.54	.39	.03
Screening Visual Discrimination	S-VIS	43.8	13.6	–.21	–.17	–.09	–.05	.02	.12	–.02	.12	.08	.16
Screening Design Construction	S-DES	37.4	8.3	–.36	–.39	–.32	–.21	–.29	–.33	.07	.53	.35	–.02
Screening Mazes	S-MAZ	31.7	8.6	–.36	–.31	–.41	–.29	–.15	.00	.28	.26	.24	.08
Screening Word Generation	S-WGN	41.6	9.9	–.33	–.51	–.11	–.10	–.25	–.26	.25	.35	.34	.02
Domain/Index score													
Screening Attention Domain	S-ATT	69.4	11.2	–.21	–.18	–.17	–.22	–.22	.01	.04	.10	.09	.00
Screening Language Domain	S-LAN	91.2	16.7	–.12	–.20	–.21	–.44	–.44	–.30	.16	.33	.41	.04
Screening Memory Domain	S-MEM	89.5	15.2	–.12	–.17	–.09	–.19	–.39	–.49	.15	.54	.33	.00
Screening Spatial Domain	S-SPT	82.8	15.3	–.31	–.31	–.20	–.11	–.13	–.11	.04	.41	.26	.08
Screening Executive Functions Domain	S-EXE	76.3	13.7	–.32	–.42	–.28	–.18	–.20	–.12	.27	.31	.29	.02
Total Screening Index	S-NAB	74.7	14.1	–.25	–.25	–.25	–.28	–.44	–.31	.17	.48	.36	.01
M				2.0	1.9	2.2	2.2	2.3	2.1	5.8	5.0	5.0	82.0
SD				1.0	1.1	1.4	1.2	1.2	1.1	1.0	1.2	1.2	14.8
N				36	36	37	37	37	37	37	37	37	37

Note. FIM = Functional Independence Measures (Granger, Hamilton, & Sherwin, 1986).

[a]Rating scale: 1 = *Never or almost never has a problem* (0%-10% of the time), 2 = *Occasionally has a problem* (11%-25% of the time), 3 = *Frequently has a problem* (26%-50% of the time), 4 = *Often has a problem* (51%-75% of the time), 5 = *Always or almost always has a problem* (>75% of the time).

score, $r = .41$; and Screening Executive Functions Domain, $r = .31$). In addition, the correlation between the FIM Memory item and the NAB Total Screening Index was .48. Similar correlations were found between the OT Memory Rating and the Screening Domain Scores and Total Index Score (see Table 6.17).

The correlations between the Screening Module Memory test scores and the FIM and OT memory scores provide further criterion validity evidence. As expected, the correlations between Story Learning Delayed Recall and FIM and OT memory ratings were higher than those between any other Screening Module scores and the functional memory measures. In addition to providing additional support for the criterion-related validity of the NAB Screening Module memory scores, the results from this inpatient rehabilitation group study provide initial support for the ecological validity of the NAB measures.

Criterion Measures of Spatial Processing

Correlations for a nonimpaired sample. Relationships between the NAB Screening Spatial Domain and test scores and external criterion measures of visuospatial ability are presented in Table 6.18. Several measures from the WMS-III (Wechsler, 1997b), one measure from the WAIS-III (Wechsler, 1997a), Rey-Osterrieth Complex Figure (ROCF, Rey, 1941), RBANS (Randolph, 1998), and Judgment of Line Orientation (JOLO; Benton, Hamsher, Varney, & Spreen, 1983) were selected as criterion measures of spatial processing. The WAIS-III and WMS-III measures are scaled scores ($M = 10$, $SD = 3$). The ROCF was administered and scored according to the Boston Qualitative Scoring System (BQSS; Stern et al., 1999). The BQSS Presence and Accuracy scores are T scores ($M = 50$, $SD = 10$), and the Copy Fragmentation and Copy Planning measures are reported in raw score units. The RBANS Visual Construction Index is a standard score ($M = 100$, $SD = 15$), and the RBANS Figure Copy and RBANS Line Orientation are reported in raw score units. Finally, the JOLO Total Score is also a raw score.

An examination of the relationship between the NAB Screening Visual Discrimination (S-VIS) primary score and the external variables revealed relatively low correlations; the highest relationships are with the RBANS Line Orientation ($r = .16$) and the JOLO Total Score ($r = .15$). As with some Screening Language scores, the Screening Visual Discrimination (S-VIS) test has a limited range of possible raw scores, and the low correlations are not surprising given the attenuation of the distributions. NAB Screening Design Construction (S-DES) shows moderate correlations with many of the external measures; the highest correlation is with the Block Design subtest of WAIS-III ($r = .46$), and moderate relationships are seen with the copy portion of WMS-III Visual Reproduction II, the copy and memory scores of the ROCF-BQSS, RBANS Line Orientation, RBANS Visual Construction Index, and JOLO Total Score. No appreciable relationship was found between Screening Design Construction (S-DES) and the WMS-III Visual Reproduction II Discrimination, BQSS Copy Fragmentation, BQSS Copy Planning scores, and RBANS Figure Copy.

Correlations for a clinical patient sample. Additional evidence for the criterion validity of the Screening Spatial Domain score was provided by the results of the previously described study involving patients with dementia. The criterion spatial measure for the clinical sample was the DRS-2 Construction scale. The Screening Spatial Domain score correlated positively and moderately with the DRS-2 Construction score ($r = .45$). Moreover, this was the highest correlation between the DRS-2 Construction score and the remaining Screening Domain scores (Screening Attention Domain score, $r = .39$; Screening Language Domain score, $r = .18$; Screening Memory Domain score, $r = .04$; Screening Executive Functions Domain score, $r = .40$). The correlation between the DRS-2 Construction score and the NAB Total Screening Index was .46.

The correlations between the NAB Screening Module spatial tests (Screening Visual Discrimination and Screening Design Construction) and the DRS-2 Construction score were mixed. However, the correlation of the DRS-2 Construction score with the NAB Screening Visual Discrimination (S-VIS) was moderate ($r = .48$), and with the NAB Screening Design Construction (S-DES), somewhat lower ($r = .29$).

Criterion Measures of Executive Functioning

Correlations for a nonimpaired sample. Table 6.19 presents the correlations between the NAB Screening Executive Functions scores and external criterion measures of executive functioning. A variety of measures from several instruments were selected as criterion measures, including (a) the Wisconsin Card Sorting Test (WCST; Berg, 1948; Heaton et al., 1993), (b) the WAIS-III, and (c) the Porteus Maze Test (Porteus, 1959). WCST Perseverative Responses is a T score ($M = 50$, $SD = 10$), and WCST Total Correct is a raw score. The WAIS-III Comprehension score is reported on a scaled score ($M = 10$, $SD = 3$) metric. All measures for the Porteus Mazes are reported in seconds.

The correlations between the NAB Screening Mazes (S-MAZ) score and all of the external measures are moderate in magnitude but are somewhat lower with the WCST Total Correct score. The relationships between Screening Word Generation (S-WGN) and the external measures are low, except for the correlation between S-WGN and WAIS-III

Table 6.18
Correlations Between NAB Screening Module Scores and Criterion Measures of Spatial Skills for a Nonimpaired Sample

Test/Domain Index score	Acronym	WMS-III score: Visual Reproduction II: Copy Scaled Score	WMS-III score: Visual Reproduction II: Discrimination	WAIS-III score: Block Design	BQSS score: Copy Presence and Accuracy	BQSS score: Immediate Presence and Accuracy	BQSS score: Delayed Presence and Accuracy	BQSS score: Copy: Fragmentation	BQSS score: Copy: Planning	RBANS score: Figure Copy	RBANS score: Line Orientation	RBANS score: Visual Construction Index	JOLO score: Total Score
Primary score[a]													
Screening Digits Forward	S-DGF	.26	.14	.43	.10	.12	.22	.05	.08	.15	.28	.28	.19
Screening Digits Backward	S-DGB	.23	.14	.34	.08	.12	.23	.11	.07	–.01	.34	.28	.16
Screening Numbers & Letters Part A Speed	S-N&L$_A$–spd	.07	.21	.34	.07	.21	.32	.06	.10	.11	.26	.15	.16
Screening Numbers & Letters Part A Errors	S-N&L$_A$–err	.06	.12	.17	–.02	.06	.11	.05	.06	–.05	.12	.07	.24
Screening Numbers & Letters Part A Efficiency	S-N&L$_A$–eff	.07	.29	.34	.07	.21	.30	.06	.09	.09	.26	.15	.19
Screening Numbers & Letters Part B Efficiency	S-N&L$_B$–eff	.18	.07	.47	.33	.41	.41	.16	.21	.17	.27	.31	.22
Screening Auditory Comprehension	S-AUD	.19	–.09	.43	.01	.08	.10	–.09	–.12	.18	.19	.21	.38
Screening Naming	S-NAM	.07	.05	.30	.05	.10	.02	–.05	–.01	.19	.25	.17	.26
Screening Shape Learning Immediate Recognition	S-SHL–irg	.23	.02	.39	.25	.36	.38	.01	.22	.18	.30	.34	.39
Screening Shape Learning Delayed Recognition	S-SHL–drg	.01	–.09	.33	.22	.23	.21	.06	.24	–.04	.12	.14	.29
Screening Story Learning Immediate Recall	S-STL–irc	.07	.13	.20	.00	.08	.01	–.07	.05	.24	.32	.33	.27
Screening Story Learning Delayed Recall	S-STL–drc	.04	.13	.26	.01	.13	.03	–.01	.09	.31	.26	.28	.24
Screening Visual Discrimination	S-VIS	.03	.03	.02	.04	–.11	–.08	–.07	–.09	.05	.16	.03	.15
Screening Design Construction	S-DES	.40	.02	.46	.34	.32	.43	.06	.14	.13	.44	.33	.35
Screening Mazes	S-MAZ	.05	.06	.40	.19	.30	.38	.06	.10	.09	.34	.27	.38
Screening Word Generation	S-WGN	.17	–.03	.42	.14	.21	.20	.27	.26	.18	.30	.29	.20
Secondary score[b]													
Screening Orientation	S-ORN	.04	.11	.17	.11	.13	.08	–.05	.03	.11	.12	.05	.09
Screening Digits Forward Longest Span	S-DGF–spn	.20	.18	.40	.19	.16	.30	.07	.19	.30	.32	.31	.26
Screening Digits Backward Longest Span	S-DGB–spn	.14	.11	.49	.22	.25	.37	.21	.21	.03	.44	.31	.29
Screening Shape Learning Percent Retention	S-SHL–%rt	–.05	–.01	.16	.22	.16	.17	.19	.32	.04	.14	.11	.13

(continued)

Table 6.18 (continued)
Correlations Between NAB Screening Module Scores and Criterion Measures of Spatial Skills for a Nonimpaired Sample

Test/Domain/Index score	Acronym	WMS-III score		WAIS-III score	BQSS score					RBANS score			JOLO score
		Visual Reproduction II: Copy Scaled Score	Visual Reproduction II: Discrimination	Block Design	Copy Presence and Accuracy	Immediate Presence and Accuracy	Delayed Presence and Accuracy	Copy: Fragmentation	Copy: Planning	Figure Copy	Line Orientation	Visual Construction Index	Total Score
Screening Story Learning Percent Retention	S-STL–%rt	–.03	.20	.19	.08	.15	.08	.01	.09	.24	.06	.03	.02
Screening Word Generation Perseverations	S-WGN–psv	–.08	.32	.04	–.07	.06	.09	–.04	.05	–.04	.04	.06	.26
Descriptive score[b]													
Screening Orientation to Self	S-ORN–slf	–.11	.26	–.11	–.08	–.11	–.22	–.10	–.21	–.14	–.03	–.13	–.16
Screening Orientation to Time	S-ORN–tim	–.16	–.09	.09	–.08	–.04	–.12	–.06	–.03	–.11	–.04	–.16	–.12
Screening Orientation to Place	S-ORN–plc	.12	–.07	.11	.05	–.09	–.05	–.18	–.12	–.07	.16	.03	–.06
Screening Orientation to Situation	S-ORN–sit	.05	.16	.14	.24	.17	.23	.09	.18	.42	.23	.24	.26
Screening Auditory Comprehension Colors	S-AUD–col	–.22	–.08	.17	–.10	.17	.16	.28	.08	–.12	.02	–.10	.01
Screening Auditory Comprehension Shapes	S-AUD–shp	.35	–.08	.31	.09	.05	.09	–.08	–.04	.34	.20	.29	.39
Screening Auditory Comprehension Colors/ Shapes/Numbers	S-AUD–csn	.14	.08	.31	.21	.14	.10	–.17	–.03	.39	.30	.29	.41
Screening Naming Percent Correct After Semantic Cuing	S-NAM–sem%	.02	–.28	–.22	–.02	–.20	–.08	.26	.19	.22	.09	.20	–.14
Screening Naming Percent Correct After Phonemic Cuing	S-NAM–pho%	–.13	–.15	–.02	.16	.21	.15	.10	.00	–.03	–.20	–.22	–.14
Domain/Index score													
Screening Attention Domain	S-ATT	.25	.21	.53	.20	.30	.39	.13	.15	.14	.39	.35	.25
Screening Language Domain	S-LAN	.12	–.03	.40	–.02	.06	.00	–.09	–.14	.19	.29	.19	.27
Screening Memory Domain	S-MEM	.11	.08	.42	.17	.28	.21	.00	.21	.25	.36	.39	.41
Screening Spatial Domain	S-SPT	.32	.02	.35	.28	.17	.27	.02	.07	.10	.43	.26	.37
Screening Executive Functions Domain	S-EXE	.10	.01	.49	.20	.33	.35	.18	.20	.19	.35	.34	.37
Total Screening Index	S-NAB	.26	.10	.67	.25	.35	.38	.07	.14	.27	.55	.45	.48

Note. $N = 50$. WMS-III = Wechsler Memory Scale–Third Edition (Wechsler, 1997b); WAIS-III = Wechsler Adult Intelligence Scale–Third Edition (Wechsler, 1997a); BQSS = Boston Qualitative Scoring System for the Rey-Osterrieth Complex Figure (Stern et al., 1999); JOLO = Judgment of Line Orientation (Benton, Hamsher, Varney, & Spreen, 1983)

[a] *T* scores were used to calculate correlations. [b] *z* scores were used to calculate correlations.

Table 6.19
Correlations Between NAB Screening Module Scores and Criterion Measures of Executive Functions for a Nonimpaired Sample

		WCST score		WAIS-III score	Porteus score	
Text/Domain/Index score	**Acronym**	Perseverative responses	Total correct	Comprehension	Maze 1: completion time	Maze 2: completion time
Primary score[a]						
Screening Digits Forward	S-DGF	.30	.06	.39	.02	–.09
Screening Digits Backward	S-DGB	.32	–.08	.27	–.17	–.20
Screening Numbers & Letters Part A Speed	S-N&L$_A$–spd	.23	.17	.20	–.23	–.25
Screening Numbers & Letters Part A Errors	S-N&L$_A$–err	.31	–.01	.24	–.10	–.11
Screening Numbers & Letters Part A Efficiency	S-N&L$_A$–eff	.31	.16	.28	–.26	–.23
Screening Numbers & Letters Part B Efficiency	S-N&L$_B$–eff	.28	–.01	.41	–.47	–.29
Screening Auditory Comprehension	S-AUD	.19	.01	.19	–.12	–.05
Screening Naming	S-NAM	–.07	.05	.23	–.12	–.08
Screening Shape Learning Immediate Recognition	S-SHL–irg	.16	.18	.39	–.17	–.18
Screening Shape Learning Delayed Recognition	S-SHL–drg	.19	.03	.26	–.20	–.11
Screening Story Learning Immediate Recall	S-STL–irc	.21	–.03	.21	.01	–.03
Screening Story Learning Delayed Recall	S-STL–drc	.05	–.04	.20	–.05	–.10
Screening Visual Discrimination	S-VIS	.15	.21	.24	.20	.11
Screening Design Construction	S-DES	.42	–.02	.28	–.08	–.19
Screening Mazes	S-MAZ	.39	.15	.37	–.39	–.30
Screening Word Generation	S-WGN	.08	–.03	.32	–.02	–.07
Secondary score[b]						
Screening Orientation	S-ORN	.22	.02	.25	–.25	.07
Screening Digits Forward Longest Span	S-DGF–spn	.34	.20	.38	.02	–.16
Screening Digits Backward Longest Span	S-DGB–spn	.27	–.07	.35	–.29	–.32
Screening Shape Learning Percent Retention	S-SHL–%rt	.20	.26	.07	–.23	–.20
Screening Story Learning Percent Retention	S-STL–%rt	–.09	–.05	–.04	–.16	–.23
Screening Word Generation Perseverations	S-WGN–psv	–.02	–.08	–.08	–.15	.11

(continued)

Table 6.19 (continued)
Correlations Between NAB Screening Module Scores and Criterion Measures of Executive Functions for a Nonimpaired Sample

		WCST score		WAIS-III score	Porteus score	
Text/Domain/Index score	**Acronym**	Perseverative responses	Total correct	Comprehension	Maze 1: completion time	Maze 2: completion time
Descriptive score[b]						
Screening Orientation to Self	S-ORN–slf	.20	–.11	.25	.01	.02
Screening Orientation to Time	S-ORN–tim	–.02	–.17	–.02	–.22	.04
Screening Orientation to Place	S-ORN–plc	.15	–.24	.22	.07	.03
Screening Orientation to Situation	S-ORN–sit	.01	.31	.07	.11	.12
Screening Auditory Comprehension Colors	S-AUD–col	.12	.12	–.11	–.47	–.26
Screening Auditory Comprehension Shapes	S-AUD–shp	.14	.18	.35	.09	.16
Screening Auditory Comprehension Colors/Shapes/Numbers	S-AUD–csn	.14	.16	.20	–.02	.02
Screening Naming Percent Correct After Semantic Cuing	S-NAM–sem%	–.15	–.08	–.16	.33	–.15
Screening Naming Percent Correct After Phonemic Cuing	S-NAM–pho%	–.12	–.11	–.22	–.27	–.12
Domain/Index score						
Screening Attention Domain	S-ATT	.40	.04	.46	–.30	–.27
Screening Language Domain	S-LAN	.17	.04	.25	–.13	–.11
Screening Memory Domain	S-MEM	.22	.03	.36	–.15	–.15
Screening Spatial Domain	S-SPT	.40	.10	.39	.05	–.09
Screening Executive Functions Domain	S-EXE	.28	.09	.41	–.27	–.25
Total Screening Index	S-NAB	.43	.08	.56	–.27	–.28

Note. N = 50. WCST = Wisconsin Card Sorting Test (Berg, 1948; Heaton, Chelune, Talley, Kay, & Curtiss, 1993); WAIS-III = Wechsler Adult Intelligence Scale–Third Edition (Wechsler, 1997a); Porteus = Porteus Mazes (Porteus, 1959)

[a] T scores were used to calculate correlations. [b] z scores were used to calculate correlations.

Comprehension, which is moderate. An examination of the Screening Executive Functions Domain score reveals mostly moderate correlations with external measures of executive functioning, but other Screening Domain scores also show moderate relationships, especially the Screening Attention Domain score.

Correlations for a clinical sample. Additional evidence for the criterion-related validity of the Screening Module executive functions scores was based on the results of the study involving the sample with dementia (described in detail in a subsequent section in this chapter). The criterion executive measure for the clinical sample was the DRS-2 Initiation/Perseveration scaled score. The Screening Executive Functions Domain score correlated positively and moderately with the DRS-2 Initiation/Perseveration score (r = .58). The only other Screening Domain score with a high correlation was the Screening Language Domain score (r = .66), a result not unexpected given that the DRS-2 Initiation/Perseveration score includes a verbal fluency task. The remaining correlations with the DRS-2 Initiation/Perseveration score were as follows: Screening Attention Domain score, r = .39; Screening Memory Domain score, r = –.02; and Screening Spatial Domain score, r = .02.

The correlations between the NAB Screening Module Executive Functions tests (Screening Mazes and Screening Word Generation) and the DRS-2 Initiation/Perseveration score were mixed. Whereas the correlation with Screening Mazes was high (r = .69), the correlation with Screening Word Generation was low (r = .10).

Relationships Between NAB Main Module Scores and External Neuropsychological Measures

General Measures of Cognitive Functioning

Correlations for nonimpaired samples. Table 6.20 presents descriptive statistics and correlations of NAB module index scores and external measures of overall cognitive functioning for the nonimpaired sample described earlier. The external measures of cognitive functioning included the 3MS (Teng & Chui, 1987), the MMSE (Folstein et al., 2001), and the RBANS (Randolph, 1998). The Module Index score means ranged from 93.0 (Language Index) to 98.1 (Spatial Index). Similar to the standard deviations of the Screening Domain scores, the standard deviations of the module index scores show a trend of slightly greater variability as compared to scores for the demographically corrected standardization sample. Again, as variability in a particular sample increases over and above that of the standardization sample, correlations between criterion measures tend to become inflated in a proportional manner. The correlations between the NAB Index scores and the selected measures of general cognitive functioning are all positive and relatively high. As expected, the Total NAB Index generally shows the highest, or nearly the highest, correlations with the overall summary measures. The Total NAB Index correlates with the 3MS, MMSE, and RBANS scores in the .40 to .65 range.

Table 6.21 presents the correlations between NAB module index scores and the RIST. Correlations between T-NAB and the RIST scores are mostly of moderate magnitude,

Table 6.20
Correlations Between NAB Index Scores and External Measures of General Cognitive Functioning for a Nonimpaired Sample

				3MS score	MMSE score	RBANS score
Index score	**Acronym**	***M***	***SD***	Total Score	Total Score	Total Scale
Attention Index	ATT	95.0	16.1	.37	.51	.59
Language Index	LAN	93.0	14.0	.19	.26	.38
Memory Index	MEM	94.0	16.8	.41	.53	.63
Spatial Index	SPT	98.1	17.8	.36	.33	.58
Executive Functions Index	EXE	93.8	16.4	.29	.31	.44
Total NAB Index	T-NAB	93.6	16.3	.40	.48	.65
	M			95.8	28.7	96.4
	SD			3.9	1.4	16.5
	N			50	50	48

Note. 3MS = Modified Mini-Mental Status Examination (Teng & Chui, 1987); MMSE = Mini-Mental State Examination (Folstein, Folstein, & Fanjiang, 2001); RBANS = Repeatable Battery of the Assessment of Neuropsychology Status (Randolph, 1998).

Table 6.21
Correlations Between NAB Index Scores and Reynolds Intellectual Screening Test (RIST) Scores for the Demographically Corrected Standardization Sample

		RIST score		
Index score	**Acronym**	*GWH*	*OIO*	Index
Attention Index	ATT	.30	.31	.34
Language Index	LAN	.41	.33	.41
Memory Index	MEM	.41	.35	.43
Spatial Index	SPT	.35	.40	.42
Executive Functions Index	EXE	.40	.40	.45
Total NAB Index	T-NAB	.47	.45	.51

Note. N = 1,448. RIST = Reynolds Intelligence Screening Test (Reynolds & Kamphaus, 2003); *GWH* = Guess What; *OIO* = Odd Item Out.

Table 6.22
Correlations Between the NAB Attention Module Primary Scores and the Reynolds Intellectual Screening Test (RIST) Scores for the Demographically Corrected Standardization Sample

		RIST score		
Test	**Acronym**	*GWH*	*OIO*	Index
Digits Forward	DGF	.22	.15	.21
Digits Backward	DGB	.26	.23	.28
Dots	DOT	.21	.25	.26
Numbers & Letters Part A Speed	$N\&L_A$–spd	.03	.06	.05
Numbers & Letters Part A Errors	$N\&L_A$–err	.23	.22	.25
Numbers & Letters Part A Efficiency	$N\&L_A$–eff	.06	.10	.09
Numbers & Letters Part B Efficiency	$N\&L_B$–eff	.19	.21	.22
Numbers & Letters Part C Efficiency	$N\&L_C$–eff	.11	.16	.15
Numbers & Letters Part D Efficiency	$N\&L_D$–eff	.10	.12	.12
Numbers & Letters Part D Disruption	$N\&L_D$–dis	.02	.01	.01
Driving Scenes	DRV	.29	.28	.31

Note. N = 1,448. RIST = Reynolds Intelligence Screening Test (Reynolds & Kamphaus, 2003); *GWH* = Guess What; *OIO* = Odd Item Out.

ranging from .45 (*OIO*) to .51 (RIST Index). As with the correlations between the NAB Screening Domain and Total Screening Index scores with the RIST, the module index scores share a relatively small percent of variance with the RIST measures. The overlap or shared variance with overall intelligence (*g*), as measured by the RIST Index, with the NAB module indexes range from 12% (Attention Index score) to 20% (Executive Functions Index score). There is 26% shared variance between the RIST Index and the Total NAB Index.

The NAB main module primary score correlations with the RIST are provided in Tables 6.22 through 6.26. As with to the NAB Screening Domain and Total Screening Index scores, the NAB module index scores and main module primary, secondary, and descriptive test scores show positive correlations with measures of general cognitive ability. There is, however, a large percentage of unique variance in NAB scores that is not accounted for by overall cognitive ability.

For clinicians interested in examining the relationship between NAB scores and the RIST, Tables B.2 through B.6 and Tables B.8 through B.12 in Appendix B provide the descriptive statistics for NAB main module primary, secondary, and descriptive raw scores by five RIST Index score ranges (≤79, 80-89, 90-109, 110-119 and ≥120) for Forms 1 and 2, respectively.

Correlations for a clinical patient group. The relationships between the NAB Memory Index and general measures of cognitive functioning in a clinical sample were investigated. The data from a study of outpatients with dementia (described in detail in a subsequent section in this

Table 6.23
Correlations Between the NAB Language Module Primary Scores and the Reynolds Intellectual Screening Test (RIST) Scores for the Standardization Sample

		RIST score		
Test	**Acronym**	*GWH*	*OIO*	Index
Oral Production	OPD	.18	.17	.19
Auditory Comprehension	AUD	.26	.25	.28
Naming	NAM	.43	.29	.39
Writing	WRT	.14	.10	.13
Bill Payment	BIL	.32	.29	.33

Note. *N* = 1,448. RIST = Reynolds Intelligence Screening Test (Reynolds & Kamphaus, 2003); *GWH* = Guess What; *OIO* = Odd Item Out.

Table 6.24
Correlations Between the NAB Memory Module Primary Scores and the Reynolds Intellectual Screening Test (RIST) Scores for the Standardization Sample

		RIST score		
Test	**Acronym**	*GWH*	*OIO*	Index
List Learning List A Immediate Recall	LLA–irc	.32	.25	.32
List Learning List B Immediate Recall	LLB–irc	.21	.17	.21
List Learning List A Short Delayed Recall	LLA–sd:drc	.28	.24	.29
List Learning List A Long Delayed Recall	LLA–ld:drc	.28	.24	.29
Shape Learning Immediate Recognition	SHL–irg	.23	.30	.29
Shape Learning Delayed Recognition	SHL–drg	.22	.24	.25
Story Learning Phrase Unit Immediate Recall	STL–irc:phu	.33	.27	.34
Story Learning Phrase Unit Delayed Recall	STL–drc:phu	.31	.22	.30
Daily Living Memory Immediate Recall	DLM–irc	.35	.26	.34
Daily Living Memory Delayed Recall	DLM–drc	.24	.23	.26

Note. *N* = 1,448. RIST = Reynolds Intelligence Screening Test (Reynolds & Kamphaus, 2003); *GWH* = Guess What; *OIO* = Odd Item Out.

Table 6.25
Correlations Between the NAB Spatial Module Primary Scores and the Reynolds Intellectual Screening Test (RIST) Scores for the Standardization Sample

		RIST score		
Test	**Acronym**	*GWH*	*OIO*	Index
Visual Discrimination	VIS	.21	.30	.29
Design Construction	DES	.30	.36	.37
Figure Drawing Copy	FGD–cpy	.13	.15	.15
Figure Drawing Copy Organization	FGD–cpy:org	.11	.11	.13
Figure Drawing Immediate Recall	FGD–irc	.19	.20	.22
Map Reading	MAP	.32	.33	.36

Note. *N* = 1,448. RIST = Reynolds Intelligence Screening Test (Reynolds & Kamphaus, 2003); *GWH* = Guess What; *OIO* = Odd Item Out.

Table 6.26
Correlations Between the NAB Executive Functions Module Primary Scores and the Reynolds Intellectual Screening Test (RIST) Scores for the Standardization Sample

Test	Acronym	RIST score		
		GWH	*OIO*	Index
Mazes	MAZ	.28	.31	.33
Judgment	JDG	.34	.29	.36
Categories	CAT	.49	.47	.54
Word Generation	WGN	.47	.37	.48

Note. *N* = 1,448. RIST = Reynolds Intelligence Screening Test (Reynolds & Kamphaus, 2003); *GWH* = Guess What; *OIO* = Odd Item Out.

chapter) were used for this study. The correlation between the Memory Index and the MMSE was .45. The correlation between the Memory Index and the DRS-2 Total age-corrected scaled score was .54. The correlation between the Memory Index and DRS-2 Total age- and education-corrected scaled score was .66.

As shown in Table 6.27, the correlations between individual Memory Module primary scores and the MMSE and DRS-2 Total scores are mixed. The Memory Module scores with the highest correlations with the MMSE are Daily Living Memory Delayed Recall (r = .65) and List Learning List A Immediate Recall (r = .55); the lowest correlations with the MMSE are with Shape Learning Delayed Recognition (r = –.07), Shape Learning Immediate Recognition (r = .09), and List Learning List B Immediate Recall (r = .09). The correlations between the Memory Module scores and the DRS-2 age- and education-corrected scaled score are mostly positive and high; the highest correlations are with List Learning Immediate Recall (r = .71) and Story Learning Phrase Unit Immediate Recall (r = .71); the exception is the correlation with Shape Learning Delayed Recognition (r = .19).

Criterion Measures of Attention

Correlations for nonimpaired samples. Table 6.28 presents correlations for the NAB Module Index scores and Attention Module primary, secondary, and descriptive scores, with the selected criterion measures of attention described earlier. As expected, most of the NAB scores have positive correlations with the WMS-III, TMT, RBANS, and Ruff 2&7 scores. However, the correlations between the NAB Orientation descriptive scores (ORN–slf, ORN–tim, ORN–plc, ORN–sit) and the criterion attention measures are negative or nonexistent. The lack of variability in the NAB orientation scores (i.e., few nonimpaired individuals ever miss an item) likely accounts for the low observed relationships.

For the Attention Module primary scores, Digits Forward (DGF) and Digits Backward (DGB) show the highest correlations with the WMS-III and RBANS Digit Span tests ranging from .49 to .64. There is a trend for Numbers & Letters Part A Speed (N&L_A–spd) and Numbers & Letters Part A Efficiency (N&L_A–eff) to correlate more highly with attentional speed scores (e.g., Ruff 2&7 Total Speed) than with attentional accuracy scores (e.g., Ruff 2&7 Total Accuracy). The external attention measures that are inherently more complex and more laden with working memory tend to correlate more highly with analogous NAB Attention Module scores. The pattern of correlations between the WMS-III Letter-Number Sequencing and the NAB Attention Module scores shows this clear pattern. NAB Dots (DOT) correlates most highly with the WMS-III Working Memory Index and the Ruff 2&7 Automatic Detection Accuracy score. NAB Driving Scenes (DRV) has moderate correlations with most of the criterion measure scores. There is a trend for the NAB Attention Index scores to correlate more highly with the criterion attention measures than the other NAB module Index scores.

Criterion Measures of Language

Correlations for a nonimpaired sample. Table 6.29 presents the correlations between the NAB module index scores and Language Module primary, secondary, and descriptive scores and the selected criterion measures of language described earlier. As is common in many comparisons of language measures, there is reduced variability in nonimpaired samples and subsequent correlations tend to be attenuated; the correlations observed in this study are no exception. The NAB Naming (NAM) test correlates most highly with the criterion naming measures, the Boston Naming Test and the RBANS Picture Naming. There is also a general trend for the NAB Language Index to have relatively higher correlations with the criterion language measures than the other NAB module indexes, although there are many notable exceptions suggesting that linguistic abilities play an important role in mediating multiple areas of cognitive functioning.

Table 6.27
Correlations Between NAB Memory Module Primary and Index Scores and the Mini-Mental State Examination (MMSE) and the Dementia Rating Scale (DRS-2) Total Scores for the Dementia Sample

				MMSE score	DRS-2 score		
Test/Index score	**Acronym**	***M***	***SD***	Total raw score	Total raw score	Total age-corrected scaled score	Total age- and education-corrected scaled score
Primary score							
List Learning List A Immediate Recall	LLA–irc	33.8	9.4	.55	.66	.62	.71
List Learning List B Immediate Recall	LLB–irc	38.3	7.9	.09	.57	.49	.52
List Learning List A Short Delayed Recall	LLA–sd:drc	27.5	11.0	.22	.31	.35	.46
List Learning List A Long Delayed Recall	LLA–ld:drc	32.0	8.4	.26	.32	.42	.56
Shape Learning Immediate Recognition	SHL–irg	37.4	10.3	.09	.50	.53	.60
Shape Learning Delayed Recognition	SHL–drg	38.2	11.2	–.07	.16	.06	.19
Story Learning Phrase Unit Immediate Recall	STL–irc:phu	32.1	10.7	.54	.60	.63	.71
Story Learning Phrase Unit Delayed Recall	STL–drc:phu	35.0	9.6	.31	.34	.49	.61
Daily Living Memory Immediate Recall	DLM–irc	32.3	9.5	.48	.43	.40	.50
Daily Living Memory Delayed Recall	DLM–drc	25.8	12.1	.65	.40	.50	.60
Index score							
Memory Index	MEM	67.6	14.5	.45	.49	.54	.66
	M			23.1	117.1	4.9	4.1
	SD			3.1	14.4	2.7	3.3
	N			19	14	14	14

Note. MMSE = Mini-Mental State Examination (Folstein, Folstein, & Fanjiang, 2001); DRS-2 = Dementia Rating Scale-2 (Jurica, Leitten, & Mattis, 2001).

Correlations for a clinical patient group. Because of the limited variability of NAB language scores and external criterion language measures for nonimpaired individuals, an examination of the criterion-related validity of the NAB Language Module scores for patients with known language impairment is important. Therefore, data from a study of outpatients diagnosed with aphasia (described in detail in a subsequent section in this chapter) were examined. Specifically, the relationships between the NAB Language Index and Language Module primary scores and the Boston Naming Test (BNT; Kaplan et al., 1983) and the Token Test (Benton, Hamsher, et al., 1994) were evaluated (see Table 6.30). As expected, the Language Module Index correlates very highly with both the BNT (r = .83) and the Token Test (r = .92). The correlations between the Language Module primary scores and the BNT and Token Test are all positive and generally high, providing strong support for the criterion validity of the Language Module scores.

Criterion Measures of Memory

Correlations for a nonimpaired sample. Table 6.31 presents the correlations for the NAB Module Index and Memory Module primary, secondary, and descriptive scores, and criterion measures of memory described earlier in this chapter. As expected, the NAB Memory Index and primary scores show relatively high correlations with the corresponding selected

Table 6.28
Correlations Between NAB Attention Module and Module Index Scores and Criterion Measures of Attention for a Nonimpaired Sample

				WMS-III score								
Test/Index score	Acronym	*M*	*SD*	Spatial Span Forward	Spatial Span Backward	Digit Span Forward	Digit Span Backward	Digit Span Total	L-N Sequencing	Mental Control	Working Memory	Info & Orientation
Primary score[a]												
Digits Forward	DGF	49.2	10.8	.18	.26	.57	.49	.64	.51	.08	.47	.21
Digits Backward	DGB	49.7	10.3	.29	.39	.52	.55	.64	.55	.17	.54	.07
Dots	DOT	48.3	9.9	.38	.38	.30	.27	.36	.33	.41	.45	.08
Numbers & Letters Part A Speed	$N\&L_A$–spd	50.2	9.6	.17	.21	.08	.08	.08	.16	.09	.22	.10
Numbers & Letters Part A Errors	$N\&L_A$–err	49.6	10.6	.21	.19	.40	.38	.39	.42	.12	.38	.06
Numbers & Letters Part A Efficiency	$N\&L_A$–eff	49.9	9.5	.23	.23	.17	.20	.19	.27	.12	.31	.09
Numbers & Letters Part B Efficiency	$N\&L_B$–eff	48.5	9.2	.29	.34	.23	.43	.41	.25	.22	.36	.05
Numbers & Letters Part C Efficiency	$N\&L_C$–eff	47.9	10.1	.18	.31	.48	.31	.47	.50	.20	.46	.09
Numbers & Letters Part D Efficiency	$N\&L_D$–eff	48.1	10.7	.33	.30	.36	.44	.48	.44	.41	.46	.32
Numbers & Letters Part D Disruption	$N\&L_D$–dis	49.4	11.3	.23	.13	.22	.35	.40	.27	.26	.28	.34
Driving Scenes	DRV	42.7	10.3	.17	.37	.28	.27	.32	.29	.32	.39	.08
Secondary score[b]												
Orientation	ORN	28.5	.8	.28	.13	.07	.26	.23	.18	.07	.22	.29
Digits Forward Longest Span	DGF–spn	6.7	1.3	.25	.26	.57	.55	.62	.55	.18	.50	.37
Digits Backward Longest Span	DGB–spn	4.8	1.4	.37	.42	.51	.58	.60	.51	.20	.54	.18
Descriptive score[b]												
Orientation to Self	ORN–slf	13.9	.3	.21	–.02	.09	.08	.15	.22	.15	.20	.07
Orientation to Time	ORN–tim	9.8	.5	.01	–.05	–.29	.03	–.12	–.18	–.03	–.13	.14
Orientation to Place	ORN–plc	3.8	.5	.28	–.01	–.01	–.11	.02	.03	.10	.12	.08
Orientation to Situation	ORN–sit	1.0	.2	–.08	.18	–.02	.21	.07	.06	.18	.08	.47

(continued)

Table 6.28 (continued)
Correlations Between NAB Attention Module and Module Index Scores and Criterion Measures of Attention for a Nonimpaired Sample

				WMS-III score								
Test/Index score	**Acronym**	***M***	***SD***	Spatial Span Forward	Spatial Span Backward	Digit Span Forward	Digit Span Backward	Digit Span Total	L-N Sequencing	Mental Control	Working Memory	Info & Orientation
Index score												
Attention Index	ATT			.38	.49	.58	.57	.68	.61	.37	.65	.19
Language Index	LAN			.25	.36	.36	.30	.43	.43	.42	.46	.22
Memory Index	MEM			.33	.41	.60	.49	.64	.60	.28	.62	.19
Spatial Index	SPT			.42	.51	.33	.47	.46	.53	.18	.64	.19
Executive Functions Index	EXE			.31	.27	.48	.45	.51	.45	.21	.45	.14
Total NAB Index	T-NAB			.42	.50	.58	.56	.67	.65	.32	.70	.23
	M			10.2	10.0	10.3	7.1	11.1	10.1	11.8	101.1	13.9
	SD			3.2	3.4	2.4	2.6	3.2	3.7	2.7	17.0	.4
	N			50	50	50	50	50	50	50	50	50

(continued)

Table 6.28 (continued)
Correlations Between NAB Attention Module and Module Index Scores and Criterion Measures of Attention for a Nonimpaired Sample

Test/Index score	Acronym	TMT score		RBANS score			Ruff 2 & 7 score					
		Trails A	Trails B	Digit Span	Coding	Attention	AD Speed	AD Accuracy	CS Speed	CS Accuracy	Total Speed	Total Accuracy
Primary score[a]												
Digits Forward	DGF	.19	.49	.61	.18	.53	.16	.19	.18	.20	.20	.21
Digits Backward	DGB	.49	.56	.42	.24	.46	.32	.27	.38	.38	.39	.35
Dots	DOT	.25	.38	.26	.22	.36	–.08	.47	–.03	.31	–.01	.41
Numbers & Letters Part A Speed	$N\&L_A$–spd	.11	.16	.06	.33	.15	.40	–.09	.44	–.01	.41	–.05
Numbers & Letters Part A Errors	$N\&L_A$–err	.44	.35	.19	.32	.23	.11	.38	.19	.47	.19	.46
Numbers & Letters Part A Efficiency	$N\&L_A$–eff	.24	.25	.13	.42	.23	.44	.02	.52	.10	.48	.06
Numbers & Letters Part B Efficiency	$N\&L_B$–eff	.26	.31	.15	.29	.39	.16	.57	.24	.50	.23	.5
Numbers & Letters Part C Efficiency	$N\&L_C$–eff	.25	.43	.59	.13	.44	.31	.25	.33	.32	.38	.30
Numbers & Letters Part D Efficiency	$N\&L_D$–eff	.39	.43	.53	.47	.58	.51	.33	.60	.34	.57	.35
Numbers & Letters Part D Disruption	$N\&L_D$–dis	.14	.17	.41	.13	.44	.20	.37	.23	.24	.22	.32
Driving Scenes	DRV	.16	.27	.23	.27	.32	.18	.39	.25	.50	.24	.48
Secondary score[b]												
Orientation	ORN	.33	.04	.38	.27	.31	.05	.29	.16	.25	.14	.29
Digits Forward Longest Span	DGF–spn	.19	.52	.65	.39	.58	.12	.17	.18	.19	.19	.19
Digits Backward Longest Span	DGB–spn	.45	.55	.45	.36	.45	.26	.20	.34	.34	.37	.29
Descriptive score[b]												
Orientation to Self	ORN–slf	.21	.19	.17	.06	.18	.07	.26	.19	.18	.16	.24
Orientation to Time	ORN–tim	.11	–.13	.03	–.07	–.06	–.17	–.11	–.13	–.11	–.12	–.11
Orientation to Place	ORN–plc	.06	–.07	.12	–.11	.05	–.07	.12	–.11	.13	–.07	.13
Orientation to Situation	ORN–sit	–.13	–.11	.13	.36	.18	.03	.02	.14	.02	.09	.02

(continued)

Table 6.28 (continued)
Correlations Between NAB Attention Module and Module Index Scores and Criterion Measures of Attention for a Nonimpaired Sample

Test/Index score	Acronym	TMT score		RBANS score			Ruff 2 & 7 score					
		Trails A	Trails B	Digit Span	Coding	Attention	AD Speed	AD Accuracy	CS Speed	CS Accuracy	Total Speed	Total Accuracy
Index score												
Attention Index	ATT	.42	.60	.58	.43	.64	.38	.47	.47	.50	.47	.51
Language Index	LAN	.41	.37	.28	.16	.37	.04	.52	.14	.51	.13	.55
Memory Index	MEM	.18	.38	.61	.39	.57	.29	.38	.33	.47	.36	.46
Spatial Index	SPT	.41	.33	.29	.33	.46	–.03	.43	.06	.44	.06	.46
Executive Functions Index	EXE	.37	.50	.50	.25	.46	.19	.45	.21	.47	.25	.49
Total NAB Index	T-NAB	.42	.53	.55	.39	.61	.21	.53	.29	.57	.31	.58
M		50.9	49.2	11.1	43.6	100.1	46.1	45.4	46.9	46.4	48.5	45.7
SD		10.3	11.9	2.5	11.1	19.3	9.4	10.0	10.6	12.0	10.2	10.3
N		50	49	49	49	49	50	50	50	50	50	50

Note. N = 50. WMS-III = Wechsler Memory Scale–Third Edition (Wechsler, 1997b); TMT = Trail Making Test (Reitan & Wolfson, 1993); RBANS = Repeatable Battery of the Assessment of Neuropsychology Status (Randolph, 1998); Ruff 2 & 7 = Ruff 2 & 7 Selective Attention Test (Ruff & Allen, 1996); L-N = Letter Number; A-D Automatic Detection; CS = Controlled Search.

[a] T scores were used to calculate correlations. [b] z scores were used to calculate correlations.

Table 6.29
Correlations Between the NAB Language Module and Module Index Scores and Criterion Measures of Language for a Nonimpaired Sample

				BNT score			TT score	Verbal Fluency score		RBANS score		
Test/Index score	**Acronym**	***M***	***SD***	Correct without cues	Correct with semantic cues	Correct with phonemic cues	Total Score	FAS Total Score	Animal Total Score	Picture Naming	Semantic Fluency	Language
Primary score[a]												
Oral Production	OPD	40.5	9.3	.11	.20	.18	.10	.07	.16	.11	.08	.08
Auditory Comprehension	AUD	48.2	11.7	.18	.28	.25	–.07	.19	.00	.23	.15	.20
Naming	NAM	51.3	9.6	.56	.65	.66	.01	.43	.25	.45	.38	.39
Writing	WRT	48.7	10.4	.03	.11	.11	.11	.25	.16	.11	.09	.17
Bill Payment	BIL	48.1	11.3	.28	.39	.34	.18	.36	.24	.35	.40	.56
Secondary score[b]												
Reading Comprehension	RCN	12.9	.3	.03	.00	.11	–.07	.17	.04	–.07	.27	.12
Writing Legibility	WRT–leg	2.0	.1	–.14	–.23	–.18	–.09	–.15	–.07	–.03	.01	–.06
Writing Spelling	WRT–spl	2.7	.5	–.12	–.21	–.14	–.06	–.10	–.10	.01	.02	–.03
Writing Syntax	WRT–syn	2.9	.4	–.14	–.24	–.17	–.10	–.11	–.15	–.01	–.03	–.08
Writing Conveyance	WRT–cnv	2.3	.6	–.03	–.01	.04	–.09	.00	–.06	–.05	–.04	–.07
Descriptive score[b]												
Auditory Comprehension Colors	AUD–col	12.9	.4	–.01	.02	–.01	–.03	–.08	–.10	–.06	.03	–.13
Auditory Comprehension Shapes	AUD–shp	21.7	.8	.21	.27	.27	.09	.08	.17	.58	–.07	.28
Auditory Comprehension Colors/Shapes/Numbers	AUD–csn	20.7	.7	.43	.47	.41	–.04	–.10	.12	.49	.19	.43
Auditory Comprehension Pointing	AUD–pnt	6.0	.0	—	—	—	—	—	—	—	—	—
Auditory Comprehension Yes/No	AUD–y/n	9.6	.9	.20	.27	.33	.01	.35	.20	–.05	.35	.24
Auditory Comprehension Paper Folding	AUD–fld	15.9	1.6	.21	.24	.29	–.07	.17	.05	.08	.32	.31
Naming Percent Correct After Semantic Cuing	NAM–sem%	26.7	39.6	.16	.03	.08	.22	.15	.03	–.01	.28	.16
Naming Percent Correct After Phonemic Cuing	NAM–pho%	66.8	39.6	–.02	–.05	–.10	.02	–.18	–.18	–.14	.07	–.07
Reading Comprehension Words	RCN–wrd	6.0	.1	.16	.26	.20	.09	.15	.15	.02	.05	.10
Reading Comprehension Sentences	RCN–sen	7.0	.2	–.12	–.22	–.15	–.09	–.09	–.12	–.04	.03	–.05

(continued)

Table 6.29 (continued)
Correlations Between the NAB Language Module and Module Index Scores and Criterion Measures of Language for a Nonimpaired Sample

				BNT score			TT score	Verbal Fluency score		RBANS score		
Test/Index score	**Acronym**	***M***	***SD***	Correct without cues	Correct with semantic cues	Correct with phonemic cues	Total Score	FAS Total Score	Animal Total Score	Picture Naming	Semantic Fluency	Language
Index score												
Attention Index	ATT			.27	.38	.40	.25	.42	.32	.25	.39	.44
Language Index	LAN			.36	.51	.48	.12	.38	.27	.40	.33	.43
Memory Index	MEM			.39	.43	.43	.11	.46	.40	.38	.35	.38
Spatial Index	SPT			.25	.26	.26	.20	.30	.16	.22	.26	.38
Executive Functions Index	EXE			.30	.30	.29	.29	.48	.10	.17	.19	.20
Total NAB Index	T-NAB			.37	.44	.44	.24	.49	.29	.34	.36	.42
M				51.4	53.0	55.8	43.9	47.2	48.5	9.7	19.9	98.2
SD				8.0	6.3	4.8	.4	9.0	10.5	.6	4.3	9.8
N				50	50	50	50	50	50	49	49	49

Note. — = Correlation not able to be computed because of zero variance. Means and standard deviations for primary scores are *T*-score metric; means and standard deviations for secondary and descriptive scores are raw scores. BNT = Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1983); TT = Token Test (Benton, Hamsher, & Sivan, 1994); FAS = FAS Score of the Multilingual Aphasia Examination (Benton, Hamsher, & Sivan, 1994); RBANS = Repeatable Battery of the Assessment of Neuropsychology Status (Randolph, 1998).

[a] *T* scores were used to calculate correlations. [b] *z* scores were used to calculate correlations.

Table 6.30
Correlations Between NAB Language Module Primary and Index Scores and the Boston Naming Test (BNT) and Token Test (TT) Scores in the Aphasia Sample

Test/Index score	Acronym	*M*	*SD*	BNT score	TT score
Primary score					
Oral Production	OPD	34.0	10.6	.74	.66
Auditory Comprehension	AUD	24.3	10.6	.50	.55
Naming	NAM	29.2	13.8	.76	.68
Writing	WRT	30.6	15.9	.66	.77
Bill Payment	BIL	28.6	8.9	.50	.66
Index score					
Language Index	LAN	61.6	15.5	.83	.92
	M			34.7	24.5
	SD			18.7	14.2
	N			21	20

Note. BNT = Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1983); TT = Token Test (Benton, Hamsher, & Sivan, 1994).

criterion memory measures. For example, Memory Module List Learning scores have slightly higher correlations with the CVLT-II than they do with WMS-III verbal memory measures. Similarly, the relative convergent-divergent relationship exists between the NAB narrative memory scores (Story Learning) and the corresponding WMS-III measures and the CVLT-II scores. The visual, or less verbally mediated, NAB memory scores (e.g., Shape Learning) have relatively higher correlations with WMS-III visual memory measures than with WMS-III verbal measures.

The NAB Daily Living Memory scores show moderate relationships with many of the criterion measures of visual and verbal memory. Additionally, many of the NAB Memory Module secondary and descriptive scores show positive correlations of moderate magnitude with similar external measures. The NAB List Learning Semantic Clusters (LL–sem) descriptive score, for example, shows moderate to high positive correlations with many of the external measures and correlates .45 with the CVLT-II Semantic Clustering score. As expected, the NAB Memory Index generally correlates more highly with the criterion measures of memory than the other module index scores.

Correlations for a clinical patient group. Additional evidence for the criterion-related validity of the Memory Module was provided by the results of a study (described in detail in a subsequent section of this chapter) in patients with dementia. The criterion memory measure for the clinical sample was the DRS-2 Memory age-corrected scaled score. As shown in Table 6.32, the Memory Index correlates highly with the DRS-2 Memory score (r = .68). The correlations between the NAB Memory Module primary scores and the DRS-2 Memory score are all positive, ranging in magnitude from relatively low correlations with Shape Learning Delayed Recognition (r = .23) to high correlations with both Story Learning Phrase Unit Immediate Recall (r = .81) and Daily Living Memory Delayed Recall (r = .88).

Criterion Measures of Spatial Processing

Correlations for a nonimpaired sample. Table 6.33 presents correlations for the NAB Module Index, Spatial Module primary, secondary, and descriptive scores, and criterion measures of spatial processing described earlier in this chapter. As expected, NAB Visual Discrimination (VIS) tends to show higher correlations with those measures that require fine-grained visual-perceptual discrimination (e.g., RBANS Line Orientation, r = .56; and JOLO, r = .49). NAB Design Construction (DES) shows moderate to high correlations with most of the external spatial processing measures; these correlations range from .21 (BQSS Copy: Fragmentation) to .59 (WAIS-III Block Design). The NAB Figure Drawing primary scores generally show the expected correlations with the BQSS scores. Figure Drawing Copy Planning (FGD–cpy:pln), for example, correlates most highly with the BQSS Copy Planning (.50), and NAB Figure Drawing Immediate Recall (FGD–irc) is most highly correlated with the BQSS Immediate Presence and Accuracy and BQSS Delayed Presence and Accuracy scores. The NAB Map Reading (MAP) test shows moderate to moderately high correlations with most of the external spatial processing measures.

Table 6.31
Correlations Between NAB Memory Module and Index Scores and Criterion Measures of Memory for a Nonimpaired Sample

				WMS-III score				CVLT-II score									RBANS score			
Test/Index score	Acronym	*M*	*SD*	Logical Memory I: Recall total	Logical Memory II: Recall total	Visual Reproduction I: Recall total score	Visual Reproduction II: Recall total score	Trials 1-5	Semantic Clustering	Short Delay Free Recall	Long Delay Free Recall	Total Recognition Discriminability	Recall Discriminability–Long Delayed Free Recall	Total Recognition Discriminability vs. Long Delayed Discrimination	Total Repetitions	Total Intrusions	List Learning Total score	Story Memory Total score	Immediate Memory index	Delayed Memory index
Primary score[a]																				
List Learning List A Immediate Recall	LLA–irc	46.2	10.5	.13	.18	.13	.37	.43	.17	.42	.38	.34	.35	–.18	.03	–.11	.29	.22	.23	.36
List Learning List B Immediate Recall	LLB–irc	48.4	10.2	.17	.21	.16	.23	.50	.25	.34	.33	.30	.29	–.02	.17	–.14	.32	.20	.34	.31
List Learning List A Short Delayed Recall	LLA–sd:drc	45.3	10.7	.31	.36	.12	.55	.58	.33	.59	.57	.48	.50	–.18	–.01	–.15	.22	.41	.42	.36
List Learning List A Long Delayed Recall	LLA–ld:drc	45.4	11.3	.28	.37	.13	.48	.51	.38	.51	.50	.44	.47	–.19	.00	–.20	.31	.30	.35	.43
Shape Learning Immediate Recognition	SHL–irg	48.6	9.9	.09	.12	.31	.35	.34	.06	.21	.26	.27	.28	–.11	–.09	–.22	.12	.13	.13	.14
Shape Learning Delayed Recognition	SHL–drg	48.1	9.6	.33	.41	.07	.46	.51	.34	.46	.44	.44	.48	–.25	.11	–.30	.30	.30	.35	.30
Story Learning Phrase Unit Immediate Recall	STL–irc:phu	48.8	10.0	.42	.40	–.04	.16	.39	.15	.37	.31	.33	.34	–.04	.17	–.26	.29	.36	.48	.40
Story Learning Phrase Unit Delayed Recall	STL–drc:phu	49.1	9.9	.52	.50	.02	.21	.45	.27	.35	.32	.32	.31	–.09	.10	–.17	.34	.50	.53	.39
Daily Living Memory Immediate Recall	DLM–irc	47.1	10.9	.34	.35	.08	.35	.50	.40	.36	.45	.40	.34	–.20	.04	–.23	.39	.41	.45	.41
Daily Living Memory Delayed Recall	DLM–drc	45.8	11.6	.26	.39	.18	.44	.52	.32	.46	.45	.46	.41	–.26	–.01	–.33	.30	.33	.34	.37
Secondary score[b]																				
List Learning List A Trial 1 Immediate Recall	LLA1–irc	5.4	1.6	.32	.38	.04	.26	.39	.19	.50	.41	.36	.45	–.39	–.02	–.34	.48	.37	.36	.53
List Learning List A Trial 2 Immediate Recall	LLA2–irc	7.6	2.2	.11	.17	.13	.30	.35	.29	.37	.30	.34	.30	–.16	.06	–.17	.44	.24	.23	.45
List Learning List A Trial 3 Immediate Recall	LLA3–irc	8.4	2.3	.17	.19	.06	.47	.49	.38	.45	.37	.41	.37	–.12	–.08	–.20	.48	.29	.27	.49
List Learning List A Percent Retention	LLA–%rt	90.8	38.3	.11	.24	.13	.13	.22	.19	.19	.12	.24	.20	.05	.14	–.21	.42	.07	.19	.39
List Learning List A Long Delayed Forced-Choice Recognition	LLA–dfc	10.5	1.7	–.11	–.05	.10	.35	.18	.16	.20	.16	.21	.11	–.10	–.27	.01	.25	.08	.06	.14
List Learning List A Long Delayed Forced-Choice Recognition False Alarms	LLA–fa	3.4	3.2	.10	.22	.00	.22	.32	.34	.32	.30	.22	.28	–.22	.04	–.23	.30	.20	.15	.25

(continued)

Table 6.31 (continued)
Correlations Between NAB Memory Module and Index Scores and Criterion Measures of Memory for a Nonimpaired Sample

				WMS-III score				CVLT-II score									RBANS score			
Test/Index score	Acronym	*M*	*SD*	Logical Memory I: Recall total	Logical Memory II: Recall total	Visual Reproduction I: Recall total score	Visual Reproduction II: Recall total score	Trials 1-5	Semantic Clustering	Short Delay Free Recall	Long Delay Free Recall	Total Recognition Discriminability	Recall Discriminability – Long Delayed Free Recall	Total Recognition Discriminability vs. Long Delayed Discrimination	Total Repetitions	Total Intrusions	List Learning Total score	Story Memory Total score	Immediate Memory index	Delayed Memory index
List Learning List A Discriminability Index	LLA–dis	7.2	3.5	.03	.11	.05	.40	.38	.39	.37	.37	.29	.33	–.23	–.10	–.20	.34	.18	.12	.28
List Learning List A Recall vs. Recognition	LLA–rvr	61.8	30.4	.39	.52	.07	.34	.57	.42	.60	.54	.54	.58	–.25	.13	–.33	.53	.44	.50	.64
Shape Learning Trial 1 Immediate Recognition	SHL1–irg	4.6	1.5	–.14	.03	.11	.20	.13	–.03	.18	.10	.19	.16	–.12	–.13	–.28	.21	–.03	–.05	.20
Shape Learning Trial 2 Immediate Recognition	SHL2–irg	5.2	1.5	.09	.09	.23	.46	.29	.21	.22	.22	.36	.28	–.06	–.05	–.31	.43	.18	.24	.33
Shape Learning Trial 3 Immediate Recognition	SHL3–irg	5.7	1.8	.22	.18	.27	.35	.43	.32	.28	.30	.35	.32	–.10	–.04	–.24	.33	.28	.22	.31
Shape Learning Percent Retention	SHL–%rt	99.8	32.6	.09	.22	–.20	.11	.07	.15	.22	.09	.14	.18	–.15	.19	–.16	.25	.11	.18	.19
Shape Learning Delayed Forced-Choice Recognition	SHL–dfc	7.7	1.2	–.02	.15	.14	.26	–.06	.05	.11	.09	.14	.07	.03	–.11	.06	-0.04	.05	–.04	.05
Shape Learning Delayed Forced-Choice Recognition False Alarms	SHL–fa	1.0	1.5	.11	.22	.22	.39	.30	.31	.35	.20	.37	.31	–.14	.05	–.40	.52	.19	.27	.43
Shape Learning Discriminability Index	SHL–dis	6.7	1.9	.01	.20	.26	.45	.17	.27	.33	.21	.35	.27	–.11	–.05	–.26	.35	.15	.14	.35
Story Learning Trial 1 Phrase Unit	STL1–irc:phu	23.5	7.0	.45	.41	–.11	.07	.29	.14	.32	.24	.27	.30	–.07	.10	–.28	.34	.32	.44	.43
Story Learning Trial 2 Phrase Unit	STL2–irc:phu	29.9	6.7	.50	.53	–.01	.35	.51	.37	.53	.40	.47	.45	–.11	.15	–.41	.59	.54	.65	.68
Story Learning Thematic Unit Immediate Recall	STL–irc:thu	14.3	3.4	.46	.48	–.02	.19	.43	.27	.52	.40	.49	.51	–.23	.01	–.42	.50	.46	.55	.59
Story Learning Trial 1 Thematic Unit	STL1–irc:thu	6.3	1.9	.38	.39	–.13	.18	.30	.17	.35	.31	.40	.35	–.04	.01	–.29	.50	.47	.51	.54
Story Learning Trial 2 Thematic Unit	STL2–irc:thu	8.0	1.8	.24	.30	–.04	.32	.31	.10	.28	.21	.34	.22	.05	.17	–.21	.47	.24	.37	.42
Story Learning Thematic Unit Delayed Recall	STL–drc:thu	7.7	1.9	.33	.41	–.12	.23	.34	.16	.36	.24	.44	.24	.00	.02	–.21	.51	.38	.47	.51
Story Learning Phrase Unit Percent Retention	STL–%rt	90.8	14.7	.29	.34	–.07	–.07	.12	.10	.10	.06	.06	.02	–.08	–.05	.13	.06	.26	.15	.07
Daily Living Memory Retention	DLM–rt	84.6	14.3	.25	.30	.05	.36	.44	.39	.44	.37	.39	.42	–.30	–.10	–.36	.50	.33	.31	.50
Daily Living Memory Delayed Recognition	DLM–drg	8.4	1.5	.19	.28	.24	.42	.46	.27	.39	.39	.39	.44	–.29	.09	–.53	.39	.34	.29	.43

(continued)

Table 6.31 (continued)
Correlations Between NAB Memory Module and Index Scores and Criterion Measures of Memory for a Nonimpaired Sample

Test/Index score	Acronym	*M*	*SD*	WMS-III score: Logical Memory I: Recall total	WMS-III score: Logical Memory II: Recall total	WMS-III score: Visual Reproduction I: Recall total score	WMS-III score: Visual Reproduction II: Recall total score	CVLT-II score: Trials 1-5	CVLT-II score: Semantic Clustering	CVLT-II score: Short Delay Free Recall	CVLT-II score: Long Delay Free Recall	CVLT-II score: Total Recognition Discriminability	CVLT-II score: Recall Discriminability–Long Delayed Free Recall	CVLT-II score: Total Recognition Discriminability vs. Long Delayed Discrimination	CVLT-II score: Total Repetitions	CVLT-II score: Total Intrusions	RBANS score: List Learning Total score	RBANS score: Story Memory Total score	RBANS score: Immediate Memory index	RBANS score: Delayed Memory index
Daily Living Memory Recall vs. Recognition	DLM–rvr	154.6	27.2	.18	.34	.00	.28	.34	.29	.37	.26	.33	.21	–.10	–.10	–.16	.31	.19	.22	.35
Medication Instructions Immediate Recall	MED–irc	23.0	3.9	.46	.39	.04	.34	.47	.41	.30	.37	.40	.34	–.07	.12	–.34	.52	.44	.48	.48
Medication Instruction Delayed Recall	MED–drc	7.7	1.4	.29	.38	.10	.28	.43	.21	.30	.34	.39	.30	.05	.22	–.27	.41	.28	.33	.35
Medication Instruction Delayed Recognition	MED–drg	1.1	.7	.33	.33	.19	.19	.38	.20	.23	.28	.21	.36	–.11	.23	–.35	.42	.36	.42	.37
Name/Address/Phone Immediate Recall	NAP–irc	17.3	3.8	.25	.34	.06	.32	.43	.41	.43	.41	.43	.35	–.30	–.06	–.32	.50	.38	.39	.51
Name/Address/Phone Delayed Recall	NAP–drc	5.2	2.5	.12	.24	.14	.42	.39	.36	.43	.34	.41	.39	–.39	–.14	–.41	.39	.24	.22	.42
Name/Address/Phone Delayed Recognition	NAP–drg	7.3	1.1	.03	.15	.12	.41	.27	.12	.30	.24	.30	.27	–.18	.10	–.42	.26	.17	.14	.36
Descriptive score[b]																				
List Learning Semantic Clusters	LL–sem	11.4	8.0	.19	.28	.14	.47	.55	.45	.53	.54	.42	.50	–.19	.00	–.23	.38	.37	.35	.45
List Learning Perseverations	LL–psv	1.8	2.1	.15	.12	–.03	–.05	.09	.09	.21	.16	.06	.14	–.23	–.25	.05	–.10	.06	.01	.00
List Learning Intrusions	LL–int	1.6	1.9	.17	.19	–.10	.22	.36	.23	.50	.37	.40	.41	–.27	–.05	–.34	.28	.26	.22	.36
Index score																				
Attention Index	ATT			.28	.26	.34	.52	.43	.21	.42	.50	.44	.52	–.33	.03	–.35	.24	.31	.33	.32
Language Index	LAN			.27	.25	.16	.16	.34	.20	.22	.27	.17	.29	–.25	.14	–.36	.10	.22	.23	.09
Memory Index	MEM			.40	.45	.14	.51	.62	.37	.55	.55	.50	.52	–.23	.03	–.28	.39	.43	.49	.47
Spatial Index	SPT			.25	.27	.14	.33	.43	.24	.38	.51	.37	.40	–.18	.11	–.21	.21	.29	.34	.39
Executive Functions Index	EXE			.14	.18	.19	.32	.41	.31	.35	.42	.44	.42	–.28	–.16	–.23	.09	.38	.23	.26
Total NAB Index	T-NAB			.34	.35	.23	.47	.56	.34	.49	.57	.48	.54	–.33	.01	–.34	.26	.41	.41	.40
M				11.1	12.0	10.7	9.9	51.2	.3	.0	–.1	–.1	.0	56.3	.0	.0	25.8	16.6	94.3	94.7
SD				2.8	2.6	9.6	2.8	11.3	1.3	1.2	1.2	1.2	1.2	65.3	.8	1.2	5.7	4.7	17.6	15.5
N				50	50	50	50	50	50	50	50	50	50	49	50	50	49	49	49	49

Note. WMS-III = Wechsler Memory Scale–Third Edition (Wechsler, 1997b); CVLT-II = California Verbal Learning Test (Delis, Kramer, Kaplan, & Ober, 2000); RBANS = Repeatable Battery of the Assessment of Neuropsychology Status (Randolph, 1998).

[a] T scores were used to calculate correlations. [b] z scores were used to calculate correlations.

Table 6.32
Correlations Between NAB Memory Module Primary and Index Scores and the Dementia Rating Scale-2 (DRS-2) Memory Scores for the Dementia Sample

Test/Index score	Acronym	*M*	*SD*	DRS-2 score: Memory raw score	DRS-2 score: Memory Age-corrected scaled score
Primary score					
List Learning List A Immediate Recall	LLA–irc	33.8	9.4	.56	.67
List Learning List B Immediate Recall	LLB–irc	38.3	7.9	.29	.38
List Learning List A Short Delayed Recall	LLA–sd:drc	27.5	11.0	.64	.79
List Learning List A Long Delayed Recall	LLA–ld:drc	32.0	8.4	.61	.80
Shape Learning Immediate Recognition	SHL–irg	37.4	10.3	.56	.51
Shape Learning Delayed Recognition	SHL–drg	38.2	11.2	.21	.23
Story Learning Phrase Unit Immediate Recall	STL–irc:phu	32.1	10.7	.78	.81
Story Learning Phrase Unit Delayed Recall	STL–drc:phu	35.0	9.6	.62	.80
Daily Living Memory Immediate Recall	DLM–irc	32.3	9.5	.41	.63
Daily Living Memory Delayed Recall	DLM–drc	25.8	12.1	.67	.88
Index score					
Memory Index	MEM	67.6	14.5	.85	.68
M				3.4	15.8
SD				2.0	3.7
N				14	14

Note. DRS-2 = Dementia Rating Scale-2 (Jurica, Leitten, & Mattis, 2001).

Criterion Measures of Executive Functioning

Correlations for a nonimpaired sample. Table 6.34 presents correlations for the NAB Module Index and Executive Functions Module primary, secondary, and descriptive scores with criterion measures of executive functioning described earlier in this chapter. The NAB Categories (CAT) and Mazes (MAZ) primary scores have the highest correlations with the WCST Perseverative Responses score (i.e., r = .48 and r =.46, respectively), but all of the primary score correlations with the WCST Total Correct score are very low, results suggesting little shared variance. The WAIS-III Comprehension subtest correlates in the moderate to moderately high range with all of the Executive Functions Module primary scores, results suggesting that a reasoning component is involved in performance on all of the NAB Executive Functions Module tests. As expected, the Porteus Maze scores correlate more highly with NAB Mazes (MAZ) than any other NAB Executive Functions Module primary score. Note that the correlations between the NAB scores and Porteus Maze scores are negative because the Porteus Maze scores are scaled in the opposite direction from the NAB scores. Specifically, higher Porteus Maze scores indicate poorer performance, whereas higher NAB *T* scores indicate better performance. The TMT Part B and FAS scores show relatively moderate correlations with most of the NAB Executive Functions Module primary scores, results suggesting common variance is shared across these conceptual domains. In contrast, the Animal Fluency test has stronger relationships with NAB Language scores than with NAB Executive Functions scores. Although the pattern of correlations between the NAB Executive Functions Module scores and the external measures shows many of the expected relationships, there is a general trend that the external criterion measures share significant portions of variance with other NAB domains. This finding suggests that executive functions underlie, or are related to, multiple neuropsychological domains.

NAB Performance of Clinical Groups

Characteristics of the Clinical Groups

The clinical sensitivity and utility of NAB scores were investigated for a variety of clinical patient groups. First, the performance of several groups with known neurological disorders or cognitive dysfunction was examined. These groups included individuals with (a) dementia, (b) aphasia, (c) traumatic brain injury, (d) human immunodeficiency virus (HIV)

Table 6.33
Correlations Between NAB Spatial Module and NAB Index Scores and Criterion Measures of Spatial Processing for a Nonimpaired Sample

				WMS-III score		WAIS-III score	BQSS score					RBANS score			JOLO score
Test/Index score	Acronym	*M*	*SD*	Visual Reproduction II: Copy	Visual Reproduction II: Discrimination	Block Design	Copy Presence and Accuracy	Immediate Presence and Accuracy	Delayed Presence and Accuracy	Copy: Fragmentation	Copy: Planning	Figure Copy	Line Orientation	Visual Construction Index	Total Score
Primary score[a]															
Visual Discrimination	VIS	50.2	10.5	.22	.21	.26	.17	.22	.20	–.02	.26	.10	.56	.40	.49
Design Construction	DES	45.9	11.9	.46	.22	.59	.49	.41	.55	.21	.45	.27	.48	.52	.36
Figure Drawing Copy	FGD–cpy	50.8	9.6	.12	.02	.21	.25	.27	.27	.09	.28	.33	.13	.29	.34
Figure Drawing Copy Organization	FGD–cpy:org	49.4	10.2	.03	–.13	.10	.06	.08	.20	.27	.35	.07	.08	.04	.16
Figure Drawing Immediate Recall	FGD–irc	47.8	9.6	.13	.24	.32	.59	.64	.64	.30	.57	.34	.25	.35	.25
Map Reading	MAP	49.3	13.2	.32	.26	.44	.16	.23	.22	–.07	.25	.18	.41	.41	.43
Secondary score[b]															
Figure Drawing Copy Fragmentation	FGD–cpy:frg	4.5	.7	.20	–0.16	.12	.13	.08	.21	.05	.24	.07	.10	.21	.13
Figure Drawing Copy Planning	FGD–cpy:pln	3.0	1.2	.05	–0.19	.30	.17	.20	.34	.46	.50	.17	.29	.20	.34
Figure Drawing Immediate Recall Organization	FGD–irc:org	6.4	2.0	.08	.13	.38	.42	.50	.53	.25	.54	.19	.30	.25	.37
Figure Drawing Immediate Recall Fragmentation	FGD–irc:frg	3.9	1.0	.20	–0.11	.27	.44	.40	.44	.11	.32	.18	.18	.17	.35
Figure Drawing Immediate Recall Planning	FGD–irc:pln	2.5	1.2	–.01	.25	.35	.28	.43	.39	.19	.40	.10	.30	.21	.24
Figure Drawing Percent Retention	FGD–%rt	71.6	18.9	–.01	.28	.29	.50	.55	.55	.26	.46	.28	.23	.20	.17
Index score[b]															
Attention Index	ATT			.27	.28	.51	.25	.38	.42	.09	.15	.10	.44	.38	.41
Language Index	LAN			.27	.10	.20	.01	.01	.02	–.10	.02	.15	.30	.27	.37
Memory Index	MEM			.17	.37	.43	.20	.38	.37	.11	.23	.24	.44	.41	.40
Spatial Index	SPT			.40	.25	.54	.38	.40	.45	.08	.44	.30	.54	.57	.55
Executive Functions Index	EXE			.23	.05	.59	.16	.23	.31	.13	.21	.05	.45	.34	.48
Total NAB Index	T-NAB			.34	.26	.59	.28	.38	.43	.10	.29	.22	.54	.50	.53
M				12.7	6.6	10.5	51.2	50.4	50.2	2.9	1.8	18.0	16.4	99.8	23.2
SD				2.8	.8	3.7	13.3	12.4	12.7	1.0	1.5	2.5	3.1	17.4	6.1
N				50	50	50	50	50	50	50	50	50	49	49	49

Note. WMS-III = Wechsler Memory Scale–Third Edition (Wechsler, 1997b); WAIS-III = Wechsler Adult Intelligence Scale–Third Edition (Wechsler, 1997a); BQSS = Boston Qualitative Scoring System for the Rey-Osterrieth Complex Figure (Stern et al., 1999); JOLO = Judgment of Line Orientation (Benton, Hamsher, Varney, & Spreen, 1983). Means and standard deviations for primary scores are *T*-score metric; means and standard deviations for secondary scores are raw scores.

[a] *T* scores were used to calculate correlations. [b] *z* scores were used to calculate correlations.

Table 6.34
Correlations Between NAB Executive Functions Module and NAB Index Scores and Criterion Measures of Executive Functioning for a Nonimpaired Sample

				WCST score		WAIS-III score	Porteus score		TMT score	Verbal Fluency score		RBANS score
Test/Index score	**Acronym**	***M***	***SD***	Perseveration Responses	Total Correct	Compre-hension	Maze 1 Completion Time	Maze 2 Completion Time	Trails B	FAS Total Score	Animal Total Score	Semantic Fluency
Primary score[a]												
Mazes	MAZ	47.8	11.5	.46	.12	.36	–.31	–.30	.36	.07	.15	.35
Judgment	JDG	45.1	9.9	.19	.01	.28	.02	.01	.30	.46	.07	.04
Categories	CAT	46.5	10.9	.48	.03	.35	–.20	–.12	.35	.42	–.02	.10
Word Generation	WGN	49.4	10.2	.17	.00	.46	.00	–.02	.43	.44	.13	.07
Secondary score[b]												
Word Generation Perseverations	WGN–psv	.9	1.3	.10	–.07	–.06	.05	–.19	–.11	.01	.11	–.02
Index score												
Attention Index	ATT			.44	.14	.53	–.28	–.08	.60	.42	.32	.39
Language Index	LAN			.25	.18	.42	.06	.25	.37	.38	.27	.33
Memory Index	MEM			.26	.12	.47	–.19	–.09	.38	.46	.40	.35
Spatial Index	SPT			.38	.10	.38	–.05	.12	.33	.30	.16	.26
Executive Functions Index	EXE			.47	.05	.50	–.18	–.16	.50	.48	.10	.19
Total NAB Index	T-NAB			.42	.12	.56	–.17	–.01	.53	.49	.29	.36
M				49.7	70.2	10.9	78.5	111.0	49.2	47.2	48.5	19.9
SD				12.8	12.1	2.9	60.6	72.8	11.9	9.0	10.5	4.3
N				49	49	50	50	50	49	50	50	49

Note. WCST = Wisconsin Card Sorting Test (Berg, 1948; Heaton, Chelune, Talley, Kay, & Curtiss, 1993); WAIS-III = Wechsler Adult Intelligence Scale–Third Edition (Wechsler, 1997a); Porteus = Porteus Mazes (Porteus, 1959); TMT = Trail Making Test (Reitan & Wolfson, 1993); FAS = FAS Scale of the Multilingual Aphasia Examination (Benton, Hamsher, & Sivan, 1994); RBANS = Repeatable Battery of the Assessment of Neuropsychology Status (Randolph, 1998). Means and standard deviations for primary scores are *T*-score metric; means and standard deviations for secondary scores are raw scores.

[a] *T* scores were used to calculate correlations. [b] *z* scores were used to calculate correlations.

and acquired immunodeficiency syndrome (AIDS), (e) multiple sclerosis, (f) conditions requiring inpatient rehabilitation, and (g) adult attention-deficit/hyperactivity disorder. In addition, performance by a group of simulated malingerers was also studied; the results of the malingering study are presented in a subsequent section. It is important to note that these clinical group studies are presented only as examples; they are not intended to be definitive exemplars or normative representations of these groups. Table 6.35 presents the demographic characteristics for age, sex, and race/ethnicity for each group that was studied. Note that not all groups completed the entire NAB; for clinical reasons, some groups received only selected NAB modules. The means and standard deviations for the available NAB scores are discussed in the subsequent sections. In addition, Tables D.1 through D.6 in Appendix D present the means and standard deviations for the NAB secondary and descriptive scores by module and by clinical group.

Clinically Relevant Standardized Score Ranges

Certain tables in this chapter present the percentage of clinical group participants who obtained NAB scores in one of eight clinically relevant *T*-score or standard score ranges. Further description of these clinical classification categories is presented in the *NAB Administration, Scoring, and Interpretation Manual* (Stern & White, 2003). The clinically relevant score range is anchored at the low end by the severely impaired range (i.e., module index scores ≤54) and at the top end by the above average (and better) range (i.e., module index scores ≥107). With this classification scheme, individuals who obtain Screening Domain, Total Screening Index, module index, or Total NAB Index scores at or below 84 are considered impaired; individuals who obtain primary *T* scores at or below 39 are considered impaired. Scores below these impairment cutoffs are further categorized into one of five impairment classifications: (a) mildly impaired, (b) mildly-to-moderately impaired, (c) moderately impaired, (d) moderately-to-severely impaired, and (e) severely impaired.

Individuals who obtain Screening Domain, Total Screening Index, module index, or Total NAB Index scores at or above 85 are considered intact, or nonimpaired. Individuals who obtain primary *T* scores at or above 40 are considered intact, or nonimpaired. Those individuals scoring above the impaired range fall into one of three nonimpaired categories: (a) below average, (b) average, and (c) above average. For comparison purposes, the tables also report the total percentage of study participants who fell into any impaired or nonimpaired range, along with the percentage of individuals,

Table 6.35
Demographic Characteristics of Participants in the Special Group Studies

Characteristic	Special groups: Dementia	Aphasia	Traumatic Brain Injury	HIV/AIDS	Multiple Sclerosis	Rehabilitation inpatients	Adult ADHD
Age							
M	78.0	58.9	42.0	45.1	43.4	65.5	30.7
SD	4.8	12.4	11.2	6.2	9.9	15.9	13.3
Sex							
Female	65.0	7.4	40.6	31.6	77.4	51.3	53.3
Male	35.0	92.6	59.4	68.4	22.6	48.7	46.7
Race/Ethnicity[a]							
Caucasian	100.0	81.5	100.0	89.5	100.0	92.3	100.0
African American	0.0	3.7	0.0	5.3	0.0	5.1	0.0
Hispanic	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	2.6	0.0
N	20	27	32	19	31	39	30

Note. Age is reported in years; all other statistics are reported as percentages. HIV/AIDS = Human immunodeficiency virus/acquired immune deficiency syndrome; ADHD = Attention-deficit/ hyperactivity disorder.

[a]One participant in the aphasia group and one participant in the HIV/AIDS group did not report their ethnicity.

based on the normal curve distribution, who would be predicted (i.e., expected) to score in this range. As such, the percentage of individuals predicted from the normal distribution serves as the best estimate of expected performance and, thus, serves as a "control group" for interpreting the percentage of the clinical group in each score range.

One issue that warrants a brief discussion concerns the interpretive implications or inferences one draws from the percentage of clinical groups that fall into the various clinically relevant score ranges. The tables that present these data are intended to be primarily descriptive in nature. Specifically, the percentage of clinical group participants in either the total impaired or total nonimpaired score ranges does not speak to the traditional sensitivity–specificity diagnostic accuracy rate of NAB scores. With rare exceptions, the diagnosis of individuals with neurological/neuropsychological disorders is a clinical diagnosis based on multiple criteria from a variety of information sources. For example, a dementia diagnosis is based on specific *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (*DSM-IV-TR*; American Psychiatric Association, 2000) criteria that involve integrating findings from a comprehensive evaluation, including mental status examinations, expert clinical judgment, historical information from a variety of sources/informants, and information on premorbid functioning. Neuropsychological evaluations are an invaluable and often an indispensable adjunct to critical information that helps inform a diagnosis or provide information about spared/impaired cognitive functions or pattern of functioning and helps inform important treatment or placement decisions regarding the patient. Ultimately, however, the individual must meet a set of diagnostic criteria that include factors that are not merely psychometrically based. In summary, a diagnosis is a clinical judgment that is based on multiple sources of information using specific diagnostic criteria. Neuropsychological tests provide valuable information that can inform diagnostic decisions, but they do not in and of themselves "diagnose" individuals.

The clinician-based versus test-based diagnostic model is an important distinction because there is typically significant variability in neuropsychological performance among individuals with given neurological conditions. Therefore, the total percentage of individuals who fall in any given impairment or nonimpairment range does not necessarily reflect the ability or inability of a test to identify the neurological condition. Rather, it identifies the relative performance diversity that may be present in individuals who have a given neurological disorder. An example may help to illustrate this distinction. In Table 6.37, 50% of the patients with clinically diagnosed dementia are classified in one of the five impairment ranges on the basis of their Screening Attention Domain scores, and 50% are classified in one of the three nonimpaired ranges on the basis of their Screening Attention Domain scores. This finding does not indicate that the Screening Attention Domain score is only able to classify 50% of those patients with dementia. Rather, this finding is more properly interpreted as "50% of the patients with clinically diagnosed dementia exhibit various levels of attentional deficits as measured by the NAB Screening Attention Domain, whereas 50% of the patients with dementia do not currently demonstrate impairment in this domain." The classification ranges refer, then, to the level of neuropsychological functioning in a given cognitive area at a given point in time; they do not imply that an individual study participant does not meet criteria for dementia.

This interpretive reasoning is especially applicable to more discrete cognitive domains, such as an individual's attentional functioning. When multiple domains of cognitive functioning are impaired (i.e., an essential element of the *DSM-IV-TR* diagnostic criteria for dementia), the aggregate of multiple domains is more likely to reflect higher percentages of individuals scoring in the impaired range. For example, 65% of the participants with dementia scored in the impaired range on the more global Total Screening Index. Furthermore, when test content is geared toward the assessment of a defining feature of the neurological disorder, then higher impairment rates would be expected. For example, almost 90% of the patients with dementia scored in the impaired range on the Memory Index (i.e., see Table 6.37).

In summary, the tables that present the range of performance on the NAB for the various clinical groups should be viewed as descriptive in nature; these tables are used to characterize a particular group's performance across a variety of cognitive domains. The pattern of group performance certainly has implications for evaluating the NAB's ability to measure known or expected neuropsychological impairment and, as such, addresses the validity of the NAB.

Dementia

Alzheimer's disease (AD) is the most common degenerative brain disorder and the most common cause of dementia. Approximately 10% of Americans older than 65 years qualify for a diagnosis of probable Alzheimer's disease; the prevalence increases dramatically with each decade, such that approximately 25% to 50% of Americans over the age of 85 have the disease. This statistic translates to approximately 4 million Americans with AD (U.S. National Institute on Aging, 2000). Neuropsychological assessment is an important aspect of the initial evaluation of a patient with possible dementia, as well as of the subsequent follow-up and tracking of cognitive decline (Petersen et al., 2001).

The validity and utility of the NAB Screening and Memory Modules in the assessment of dementia was examined in a study conducted with 20 participants who were diagnosed with early to middle stages of dementia. The 20 participants ranged in age from 69 to 88 years (*M* = 78.0 years, *SD* = 4.9 years). The percentages of the sample by education level were 25% with ≤11 years of education, 30% with 12 years, 20% with 13 to 15 years, and 25% with ≥16 years. The average level of education was 13.0 years (*SD* = 3.0 years). The sample consisted of 65% females and 35% males, and the ethnicity of the entire sample was Caucasian. Participants were recruited through a variety of mechanisms, including (a) referrals from neuropsychological and neurological clinical practices, (b) letters written to participants in previous dementia studies informing them about the current study, and (c) flyers and announcements at Alzheimer's disease support groups and adult daycare centers. Participants were included if their Clinical Dementia Rating (CDR; Hughes, Berg, Danziger, Coben, & Markan, 1982) was between 0.5 (questionable dementia) and 1.5 (mild-to-moderate dementia); the majority of participants had a CDR of 1.0 (mild dementia). Participants were excluded if English was not their primary language, or if they had visual or auditory acuity impairments or upper extremity motor disability severe enough to preclude standard NAB administration procedures. Other exclusion criteria included (a) current alcohol or other substance dependence/abuse, (b) history of loss of consciousness due to head trauma or anoxia, (c) history of previous or current (non-AD) neurologic disorder with associated cognitive dysfunction (e.g., stroke, seizure disorder, encephalitis, MS, tumor), (d) major psychiatric illness (e.g., bipolar disorder, schizophrenia), or (e) known attention-deficit/hyperactivity disorder. All participants were community-dwelling residents and were tested either in their own home or in a hospital-based neuropsychology service examination room.

For the dementia study, participants were administered only the NAB Screening and Memory Modules. The decision to include just these two modules was based on the following rationale: (a) many patients with dementia are unable to undergo lengthy neuropsychological examinations due to fatigue; (b) there is frequently a floor effect on many neuropsychological tasks when administered to individuals with dementia; (c) most existing neuropsychological examinations geared for dementia (e.g., Jurica et al., 2001; Morris et al., 1989) are limited to 45 minutes or less; and (d) memory impairment is a necessary diagnostic feature of dementia and, therefore, inclusion of the NAB Memory Module in this study would provide useful validity information. In addition to the NAB Screening and Memory Modules, all participants were also administered the Mini-Mental State Examination (MMSE; Folstein et al., 2001), and most were also administered the Dementia Rating Scale-2 (DRS-2; Jurica et al., 2001). Participants who were too fatigued to continue testing following the NAB modules and the MMSE were not given the DRS-2. As shown in Table 6.36, the clinical group's mean MMSE score was 23.1 (*SD* = 3.1). The mean DRS-2 Total raw score was 117.1 (*SD* = 14.4), and the mean DRS-2 Total age-and education-corrected scaled score was 4.1 (*SD* = 3.3), which is in the moderately impaired range. Additionally, the DRS-2 subtest scores are provided for the purpose of characterizing the functioning of the dementia group with measures that were external to the NAB. These results indicate that, on average, the sample has normal attention, mildly impaired construction, mildly impaired initiation/perseveration, mildly impaired conceptualization skills, and severely impaired memory performance.

As shown in Table 6.37, the mean Screening Domain scores ranged from 80.3 (Screening Memory Domain score) to 89.5 (Screening Spatial Domain score). The mean Total Screening Index and Memory Index scores were 75.7 and 67.6, respectively. Table 6.37 also shows the percentage of individuals that fall into each of the five impairment ranges and three nonimpaired ranges. For example, on the Screening Attention Domain score, 10.0%, 10.0%, 15%, and 15.0% of the dementia sample obtained scores in the severe impairment, moderate impairment, and mild-to-moderate impairment, and mild impairment ranges, respectively (total impaired = 50%). Table 6.37 also presents the expected percentage of individuals that would fall into each performance range based on the normal curve distribution. For example, 14.6% of the population would be expected to fall into one of the five impairment classification ranges. An examination of the total impaired percentages in Table 6.37 shows that a significantly higher proportion of the dementia sample scored in the impaired range on a variety of NAB scores. The percentage of individuals who obtained scores in the impaired range spanned from 45.0% (Screening Spatial Domain score) to 89.3% (Memory Index score). Table 6.37 also shows the predicted percentages of individuals from the standardization sample that would be expected to fall in the nonimpaired ranges. Although approximately 85% of individuals in the standardization sample would be expected to score in the nonimpaired range, only 35% of the dementia sample obtained Total Screening Index scores in the nonimpaired range, and only 10.6% of the sample obtained Memory Index scores in the nonimpaired range.

For the Screening Module (see Table 6.38), the percentage of patients scoring in the impaired range spanned from 15.0% for Screening Shape Learning Delayed Recognition (S-SHL–drg) to 90.0% for Screening Story Learning Delayed Recall (S-STL–drc). A greater percentage of impaired performance was seen in tests of more complex functions (e.g., attention, confrontation naming, verbal memory, and spatial functioning), a finding that is entirely consistent with the cognitive deficits associated with mild-to-moderate dementia. The percentage of patients with impaired performance on the various Memory Module primary scores (see Table 6.39) was quite high, ranging from 50% for Shape Learning Delayed Recognition (SHL−drg) to 90% for List Learning List A Long Delayed Recall (LLA–ld:drc) and Story Learning Phrase Unit Delayed Recall (STL−drc:phu).

Aphasia

Aphasia refers to the impairment or loss of language functioning associated with brain damage, typically involving the left hemisphere and, more specifically, the middle cerebral artery territory of the left hemisphere (Benson & Ardilla, 1996). Aphasia can result from stroke, traumatic brain injury, degenerative disease, tumors, or other disorders. There are numerous classification schemes for the various aphasic syndromes, including those based on the historical figures who first described them (e.g., Broca's, Wernicke's), the degree of fluency in speech output (e.g., fluent, nonfluent), the primary deficits involved (e.g., expressive, receptive), and the modality of the deficits (e.g., motor, sensory). Regardless of the specific classification scheme, all aphasic syndromes are characterized along the following parameters: (a) production (including speech and writing), (b) comprehension (including auditory and reading), and (c) naming. Fluent (or Wernicke's, receptive, sensory) aphasia is characterized by an adequate amount of speech and written output (although not necessarily meaningful) but with impaired auditory and reading comprehension. Nonfluent (or Broca's, expressive, motor) aphasia, on the other hand, is characterized by adequate auditory and reading comprehension but sparse and effortful speech and written output. It is widely accepted that most aphasic patients, regardless of specific syndrome, have some difficulty with naming (Benson & Ardilla, 1996). The NAB Language Module includes measures of each of these primary language functions, and the Screening Module includes measures of auditory comprehension and naming.

A study involving 27 patients with aphasia was conducted in order to examine the validity of the NAB Screening and Language Modules. The 27 participants ranged in age from 26 to 79 years (M = 58.9 years, SD = 12.4 years). The percentages of the sample by education level were 19% with ≤11 years of education, 19% with 12 years, 19% with 13 to 15 years, and 44% with ≥16 years.

Table 6.36
Means and Standard Deviations of MMSE and DRS-2 Scores in the Dementia Sample

Score	*M*	*SD*
MMSE Total raw score	23.1	3.1
DRS-2 score		
Attention raw score	35.6	1.3
Attention age-corrected scaled score	11.4	2.1
Initiation/Perseveration raw score	27.2	7.9
Initiation/Perseveration age-corrected scaled score	5.8	3.8
Construction raw score	5.4	1.1
Construction age-corrected scaled score	8.4	2.3
Conceptualization raw score	33.1	4.5
Conceptualization age-corrected scaled score	8.4	2.8
Memory raw score	15.8	3.7
Memory age-corrected scaled score	3.4	2.0
Total raw score	117.1	14.4
Total age-corrected scaled score	4.9	2.7
Total age- and education-corrected scaled score	4.1	3.3

N = 20. MMSE = Mini-Mental State Examination (Folstein, Folstein, & Fanjiang, 2001); DRS-2 = Dementia Rating Scale-2 (Jurica, Leitten, & Mattis, 2001).

Table 6.37
Percentage of Dementia Sample Scoring Within Suggested Clinically Relevant Standard Score Ranges for the Screening Domain and Memory Index Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
Standard score range		0-54	55-61	62-69	70-76	77-84	0-84	85-91	92-106	≥107	≥85		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Domain/Index score	**Acronym**	**% of Dementia group**						**% of Dementia group**				***M***	***SD***
Screening Attention Domain	S-ATT	10.0	0.0	10.0	15.0	15.0	50.0	20.0	30.0	0.0	50.0	82.2	15.7
Screening Language Domain	S-LAN	5.0	0.0	10.0	15.0	30.0	60.0	30.0	0.0	10.0	40.0	81.2	15.1
Screening Memory Domain	S-MEM	0.0	0.0	20.0	20.0	25.0	65.0	20.0	15.0	0.0	35.0	80.3	11.1
Screening Spatial Domain	S-SPT	0.0	0.0	15.0	5.0	25.0	45.0	10.0	30.0	15.0	55.0	89.5	16.9
Screening Executive Functions Domain	S-EXE	0.0	0.0	20.0	15.0	20.0	55.0	5.0	30.0	10.0	45.0	84.9	15.2
Total Screening Index	S-NAB	10.0	5.0	20.0	15.0	15.0	65.0	30.0	5.0	0.0	35.0	75.7	13.2
Memory Index	MEM	10.5	21.1	47.4	5.3	5.3	89.3	0.0	5.3	5.3	10.6	67.6	14.5

Note. $N = 20$.

Table 6.38
Percentage of Dementia Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Screening Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of Dementia group**						**% of Dementia group**				***M***	***SD***
Screening Digits Forward	S-DGF	0.0	0.0	10.0	0.0	10.0	20.0	20.0	40.0	20.0	80.0	45.9	10.1
Screening Digits Backward	S-DGB	0.0	0.0	5.0	15.0	10.0	30.0	15.0	45.0	10.0	70.0	43.8	7.9
Screening Numbers & Letters Part A Speed	S-N&L_A–spd	0.0	15.0	10.0	30.0	0.0	55.0	0.0	40.0	5.0	45.0	37.8	12.1
Screening Numbers & Letters Part A Errors	S-N&L_A–err	0.0	0.0	10.0	10.0	0.0	20.0	0.0	50.0	30.0	80.0	48.7	9.9
Screening Numbers & Letters Part A Efficiency	S-N&L_A–eff	0.0	15.0	10.0	25.0	10.0	60.0	0.0	25.0	15.0	40.0	38.1	11.9
Screening Numbers & Letters Part B Efficiency	S-N&L_B–eff	0.0	5.0	10.0	20.0	25.0	60.0	10.0	25.0	5.0	40.0	39.3	11.0
Screening Auditory Comprehension	S-AUD	15.0	0.0	5.0	20.0	0.0	40.0	0.0	15.0	45.0	60.0	43.3	14.6
Screening Naming	S-NAM	15.0	5.0	25.0	5.0	20.0	70.0	15.0	0.0	15.0	30.0	34.4	12.4
Screening Shape Learning Immediate Recognition	S-SHL–irg	0.0	0.0	5.0	15.0	5.0	25.0	20.0	40.0	15.0	75.0	45.3	9.1
Screening Shape Learning Delayed Recognition	S-SHL–drg	0.0	0.0	0.0	10.0	5.0	15.0	15.0	45.0	25.0	85.0	49.0	9.6
Screening Story Learning Immediate Recall	S-STL–irc	5.0	0.0	0.0	25.0	20.0	50.0	30.0	15.0	5.0	50.0	39.1	8.4
Screening Story Learning Delayed Recall	S-STL–drc	0.0	35.0	20.0	15.0	20.0	90.0	5.0	5.0	0.0	10.0	29.9	7.7
Screening Visual Discrimination	S-VIS	0.0	20.0	0.0	10.0	25.0	55.0	0.0	20.0	25.0	45.0	41.7	14.1
Screening Design Construction	S-DES	0.0	0.0	5.0	10.0	15.0	30.0	10.0	35.0	25.0	70.0	46.6	10.7
Screening Mazes	S-MAZ	0.0	0.0	5.0	20.0	15.0	40.0	30.0	25.0	5.0	60.0	41.4	7.7
Screening Word Generation	S-WGN	0.0	5.0	5.0	15.0	25.0	50.0	5.0	30.0	15.0	50.0	42.4	11.8

Note. $N = 20$.

Table 6.39
Percentage of Dementia Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Memory Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of Dementia group**						**% of Dementia group**				***M***	***SD***
List Learning List A Immediate Recall	LLA–irc	10.0	5.0	15.0	25.0	25.0	80.0	5.0	15.0	0.0	20.0	33.8	9.4
List Learning List B Immediate Recall	LLB–irc	0.0	5.0	10.0	10.0	30.0	55.0	15.0	30.0	0.0	45.0	38.3	7.9
List Learning List A Short Delayed Recall	LLA–sd:drc	25.0	30.0	30.0	0.0	0.0	85.0	0.0	10.0	5.0	15.0	27.5	11.0
List Learning List A Long Delayed Recall	LLA–ld:drc	0.0	25.0	20.0	20.0	25.0	90.0	0.0	10.0	0.0	10.0	32.0	8.4
Shape Learning Immediate Recognition	SHL–irg	10.0	5.0	5.0	15.0	25.0	60.0	5.0	35.0	0.0	40.0	37.4	10.3
Shape Learning Delayed Recognition	SHL–drg	5.0	10.0	5.0	20.0	10.0	50.0	15.0	25.0	10.0	50.0	38.2	11.2
Story Learning Phrase Unit Immediate Recall	STL–irc:phu	5.0	20.0	20.0	30.0	10.0	85.0	5.0	5.0	5.0	15.0	32.1	10.7
Story Learning Phrase Unit Delayed Recall	STL–drc:phu	0.0	0.0	30.0	40.0	20.0	90.0	0.0	5.0	5.0	10.0	35.0	9.6
Daily Living Memory Immediate Recall	DLM–irc	5.0	15.0	15.0	25.0	25.0	85.0	10.0	0.0	5.0	15.0	32.3	9.5
Daily Living Memory Delayed Recall	DLM–drc	52.6	21.1	10.5	0.0	0.0	84.2	5.3	0.0	10.5	15.8	25.8	12.1

Note. $N = 20$.

The average level of education was 14.5 years (*SD* = 3.4 years). The study consisted of 7% females and 93% males, with the following race/ethnicity distribution: 82% Caucasian, 4% African American (4 participants chose not to respond). All participants were community-dwelling residents and were recruited from the clinical practices of both speech-language pathologists and neuropsychologists, as well as from aphasia support groups. Aphasia diagnoses and classifications were made by speech-language pathologists, neuropsychologists, or neurologists prior to participation in the study. Of the total group, 19 had nonfluent aphasia, 2 had fluent aphasia, 1 had global aphasia, and 5 had another type (or an unspecified) aphasia. Participants were included only if they were able to use one or both upper extremities, had adequate visual and auditory acuity, and spoke English as their primary language (i.e., prior to aphasia onset). In addition to the NAB Screening and Language Modules, all aphasia patients were also administered the Boston Naming Test (BNT; Kaplan et al., 1983), a 60-item assessment that has a possible range of 0-60 points, and the Token Test (TT; Benton, Hamsher et al., 1994), a 22-item assessment that has a possible range of 0-44 points. The aphasia group mean raw score on the BNT was 34.7 (*SD* = 18.7), and on the TT, 24.5 (*SD* = 14.2).

As shown in Table 6.40, 82.6% of the aphasia group scored in the impaired range on the Screening Language Domain score, with 65.2% scoring in the severely impaired range. On the Screening Domain scores, the aphasia group performed best on the Screening Spatial Domain, but the percentage scoring in the impaired range for other Screening Domain scores were all at least more than 60% (the Screening Attention Domain and Screening Executive Functions Domain scores showing impairment percentages of about 90%). The percentage of impaired performance for the Screening Module primary scores (Table 6.41) ranged from 18.5% for Screening Shape Learning Immediate Recognition (S-SHL–irg), Screening Shape Learning Delayed Recognition (S-SHL–drg), and Screening Visual Discrimination (S-VIS) to 85.1% for Screening Digits Forward (S-DGF). Also of note are the high percentages of severely impaired performance on the Screening Auditory Comprehension (S-AUD) and Screening Naming (S-NAM) primary scores (77.8% and 66.7%, respectively). Finally, the Language Module primary scores (see Table 6.42) reveal mean scores of about 2 *SD*s or more below the mean for all scores. Given these low mean scores, it is not surprising that there are very large percentages of aphasic patients who score in the impaired range, with a significant proportion scoring in the severe range. The mean Language Index score was 61.4 (*SD* = 15.5), with 86.2% of the study participants scoring in the impaired range (see Table 6.40).

Traumatic Brain Injury

Traumatic brain injury (TBI) is a leading cause of disability and death among young adults in the U.S. An estimated 1.5 million Americans sustain a TBI each year, with 80,000 to 90,000 individuals experiencing the onset of long-term disability (Centers for Disease Control and Prevention, 1999). Neuropsychological impairment, ranging from mild to severe, is one of the most common sequelae of TBI. Even mild injuries can result in disabling neuropsychological deficits (Rizzo & Tranel, 1996; Varney & Roberts, 1999). Neuropsychological impairment following TBI not only can have a dramatic impact on the patient's overall well-being but also can have a significant effect on caregiver stress (Ergh, Rapport, Coleman, & Hanks, 2002). The evaluation of disability in a patient with cognitive complaints following TBI requires a neuropsychological examination (McPeak, Stiers, & Cope, 2001), and comprehensive neuropsychological evaluations soon after the initial injury can help predict long-term outcome (Boake et al., 2001; Sherer et al., 2002). Because TBIs are often the result of motor vehicle or other similar accidents, individuals with TBI, even mild TBI, often are involved in litigation. These cases make up a large percentage of the practice of forensic neuropsychology (Sweet, 1999).

Because of the nature of many accidents leading to TBI (e.g., motor vehicle accident in which the head hits the windshield), there are two common types of resulting cerebral injury: (a) damage to the frontal lobes and (b) diffuse axonal injury. Frontal lobe injury can result in a variety of cognitive and behavioral impairments, including, but not limited to, reduced executive functioning (e.g., poor planning, organization, mental flexibility, generativity, conceptualization, and problem solving), disinhibition, poor impulse control, perseveration, apathy, and abulia. Diffuse axonal injury can lead to slowed information processing speed and psychomotor speed, as well as various attention problems.

To examine NAB performance in TBI patients, a study was conducted in which 31 participants with mild to moderate TBI were administered all six NAB modules. The 31 participants ranged in age from 20 to 66 years (*M* = 42.0 years, *SD* = 11.2 years). The percentages of the sample by education level were 6% with ≤11 years of education, 25% with 12 years, 25% with 13 to 15 years, and 44% with ≥16 years. The average level of education was 14.4 years (*SD* = 2.9 years). The study consisted of 41% females and 59% males, and the ethnicity of the entire sample was Caucasian. All participants were community-dwelling outpatients who were recruited either through a private neuropsychology practice specializing in TBI or through flyers and announcements at physician offices and the local Brain Injury Association.

Table 6.40
Percentage of Aphasia Sample Scoring Within Suggested Clinically Relevant Standard Score Ranges for the Screening Domain and Language Index Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
Standard score range		0-54	55-61	62-69	70-76	77-84	0-84	85-91	92-106	≥107	≥85		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Domain/Index score	**Acronym**	**% of aphasia group**						**% of aphasia group**				***M***	***SD***
Screening Attention Domain	S-ATT	50.0	20.0	0.0	10.0	10.0	90.0	5.0	5.0	0.0	10.0	61.5	15.3
Screening Language Domain	S-LAN	65.2	0.0	0.0	0.0	17.4	82.6	0.0	13.0	4.3	17.3	61.7	24.9
Screening Memory Domain	S-MEM	0.0	4.3	17.4	26.1	13.0	60.8	4.3	21.7	13.0	39.0	83.1	16.7
Screening Spatial Domain	S-SPT	0.0	0.0	0.0	13.0	26.1	39.1	13.0	43.5	4.3	60.8	90.9	11.6
Screening Executive Functions Domain	S-EXE	4.5	22.7	22.7	27.3	13.6	90.8	0.0	9.1	0.0	9.1	70.4	12.4
Total Screening Index	S-NAB	31.6	10.5	31.6	15.8	5.3	94.8	5.3	0.0	0.0	5.3	63.4	10.7
Language Index	LAN	54.5	4.5	9.1	13.6	4.5	86.2	9.1	4.5	0.0	13.6	61.4	15.5

Note. $N = 27$.

Table 6.41
Percentage of Aphasia Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Screening Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of aphasia group**						**% of aphasia group**				***M***	***SD***
Screening Digits Forward	S-DGF	25.9	22.2	7.4	11.1	18.5	85.1	0.0	7.4	7.4	14.8	30.9	13.2
Screening Digits Backward	S-DGB	14.8	14.8	22.2	22.2	3.7	77.7	3.7	11.1	7.4	22.2	32.0	11.3
Screening Numbers & Letters Part A Speed	S-N&L_A–spd	20.8	16.7	25.0	4.2	12.5	79.2	16.7	0.0	4.2	20.9	29.4	10.3
Screening Numbers & Letters Part A Errors	S-N&L_A–err	11.5	7.7	3.8	0.0	3.8	26.8	7.7	53.8	11.5	73.0	44.4	14.0
Screening Numbers & Letters Part A Efficiency	S-N&L_A–eff	20.0	20.0	20.0	8.0	12.0	80.0	16.0	4.0	0.0	20.0	29.4	9.2
Screening Numbers & Letters Part B Efficiency	S-N&L_B–eff	15.4	23.1	30.8	11.5	3.8	84.6	3.8	3.8	7.7	15.3	29.9	12.8
Screening Auditory Comprehension	S-AUD	74.1	3.7	0.0	0.0	0.0	77.8	0.0	18.5	3.7	22.2	26.6	14.3
Screening Naming	S-NAM	63.0	3.7	0.0	0.0	0.0	66.7	0.0	18.5	14.8	33.3	31.1	17.1
Screening Shape Learning Immediate Recognition	S-SHL–irg	0.0	0.0	0.0	3.7	14.8	18.5	7.4	29.6	44.4	81.4	51.1	9.4
Screening Shape Learning Delayed Recognition	S-SHL–drg	0.0	0.0	0.0	7.4	11.1	18.5	11.1	37.0	33.3	81.4	49.4	9.5
Screening Story Learning Immediate Recall	S-STL–irc	25.9	22.2	11.1	3.7	3.7	66.6	11.1	14.8	7.4	33.3	32.4	15.0
Screening Story Learning Delayed Recall	S-STL–drc	0.0	22.2	22.2	14.8	11.1	70.3	7.4	11.1	11.1	29.6	34.5	11.6
Screening Visual Discrimination	S-VIS	3.7	0.0	0.0	7.4	7.4	18.5	11.1	29.6	40.7	81.4	49.5	10.7
Screening Design Construction	S-DES	0.0	3.7	7.4	11.1	29.6	51.8	18.5	18.5	11.1	48.1	40.5	9.6
Screening Mazes	S-MAZ	7.7	15.4	19.2	15.4	15.4	73.1	15.4	3.8	7.7	26.9	34.5	11.5
Screening Word Generation	S-WGN	7.4	7.4	14.8	11.1	37.0	77.7	14.8	7.4	0.0	22.2	34.7	9.1

Note. $N = 27$.

Table 6.42
Percentage of Aphasia Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Language Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of aphasia group**						**% of aphasia group**				***M***	***SD***
Oral Production	OPD	8.7	4.3	39.1	8.7	4.3	65.1	13.0	17.4	4.3	34.7	34.0	10.6
Auditory Comprehension	AUD	66.7	14.8	0.0	0.0	7.4	88.9	0.0	11.1	0.0	11.1	24.3	10.6
Naming	NAM	50.0	7.7	7.7	7.7	3.8	76.9	0.0	15.4	7.7	23.1	29.2	13.8
Writing	WRT	51.9	11.1	0.0	3.7	0.0	66.7	7.4	3.7	22.2	33.3	30.6	15.9
Bill Payment	BIL	25.9	14.8	11.1	29.6	7.4	88.8	7.4	3.7	0.0	11.1	28.6	8.9

Note. $N = 27$.

The sample represents a wide spectrum of TBI patients. Fifteen percent of the participants were examined within 3 months of their injury, 38% were examined between 4 and 12 months postinjury, 35% were examined between 13 and 24 months postinjury, and 12% were examined 25 or more months postinjury. All patients had neuroimaging studies; 39% had positive findings on either CT or MRI. Most participants had either no loss of consciousness (LOC; 27%) or just a brief (<10 minutes) LOC (49%), with 4% having a 10- to 30-minute LOC, 8% having a 30- to 180-minute LOC, and 12% having an extended (3 to 5 days) LOC or coma. Glasgow Coma Scale ratings (Teasdale & Jennett, 1974) were not available for most participants. The large majority (73%) had less than 1 day of posttraumatic amnesia (PTA), with 8% having 1 to 2 days of PTA, and 19% having 3 to 7 days of PTA. Most participants (85%) were involved in some form of litigation at the time of testing.

In addition to the NAB, all TBI patients were administered the Modified Mini-Mental State Examination (3MS; Teng & Chui, 1987), and most participants had also recently received the Wechsler Adult Intelligence Test, Third Edition (WAIS-III; Wechsler, 1997a), the Symbol Digit Modalities Test (SDMT; Smith, 1991), the Trail Making Test (TMT; Reitan & Wolfson, 1993), the Memory Assessment Scales (MAS; Williams, 1991), the Hooper Visual Organization Test (HVOT; Hooper, 1958), and the Test of Memory Malingering (TOMM; Tombaugh, 1996).

The TBI group, on average, had intact overall cognitive functioning, as measured by the 3MS and WAIS-III IQ scores. Some aspects of psychomotor speed, memory, and executive functions were, however, below average or mildly impaired, as measured by the WAIS-III, the TMT Part B, and the MAS. Although the large majority of participants were engaged in some form of litigation at the time of testing, their performance on the TOMM was not indicative of suboptimal effort or malingering.

Tables 6.43 to 6.49 present the percentages of TBI patients who obtained NAB scores in the various clinically relevant standardized score ranges, along with the means and standard deviations of NAB scores. As expected, the mean module index scores are somewhat lower than the corresponding Screening Domain scores. In terms of the percentage of individuals who scored in the impaired range, most scored at or above the mildly-to-moderately impaired *T*-score range, a finding that corresponds well with their clinical diagnoses of mild to moderately severe TBI. Of the Screening Domain and module index primary scores, greater percentages of impaired performance were seen in the attention, memory, and executive functions areas; again, this finding closely parallels the published research regarding cognitive deficits associated with TBI (Bohen, Jolles, & Twijnstra, 1992; Capruso & Levin, 1992; Reimer et al., 1995). An examination of the Attention Module primary scores (Table 6.45) reveals higher percentages of impaired performance (i.e., as compared to expected performance in normal individuals) for most scores, with the more complex and speeded tasks showing the greater percentages of impairment (e.g., N&L_A–spd). Relative to the other modules, there were few appreciable deficits in the Language Module (Table 6.46).

Tables 6.43 to 6.49 generally show consistently higher percentages of impaired performance for the TBI group than would be expected for the general population. The main module primary scores demonstrate a greater percentage of impaired functioning in attention, memory, spatial, and executive functions tasks. As is typical in most studies of mild to moderate TBI, there is significant variability in the range of performance. Whereas some study participants performed in the nonimpaired range in many areas, a sizeable percentage of study participants performed in the impaired ranges in specific areas of neuropsychological functioning.

Human Immunodeficiency Virus

Neuropsychological deficits are common in both human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS). Although the clinical presentation can vary from individual to individual, the overall picture of HIV-associated minor cognitive-motor disorder, as well as HIV-associated dementia, involves subcortical and frontal systems dysfunction. This includes problems with working memory, slowing of psychomotor and information processing speed, attention difficulties, and problems with free recall in memory assessments (Paul, Cohen, & Stern, 2002; Stern, Perkins, & Evans, 1995).

To examine NAB performance by patients with HIV/AIDS, a study was conducted with a group of 19 HIV-infected individuals. The 19 participants ranged in age from 35 to 55 years (*M* = 45.1 years, *SD* = 6.2 years). The percentages of the sample by education level were 32% with ≤11 years of education, 36% with 12 years, 27% with 13 to 15 years, and 5% with ≥16 years. The average level of education was 12.0 years (*SD* = 2.2 years). The study consisted of 32% females and 68% males, with the following race/ethnicity distribution: 90% Caucasian, 5% Hispanic (1 participant chose not to respond). All six NAB modules were administered, as was the Mini-Mental Status Examination (Folstein et al., 2001) and the Modified Mini-Mental State Examination (3MS; Teng & Chui, 1987). Participants were recruited from infectious disease/HIV clinics, and HIV/AIDS status was confirmed by each participant's physician. None of the participants was diagnosed with HIV-associated dementia, and none was referred or recruited because of

Table 6.43
Percentage of Traumatic Brain Injury (TBI) Sample Scoring Within Suggested Clinically Relevant Standard Score Ranges for the Screening Domain and Module Index Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
Standard score range		0-54	55-61	62-69	70-76	77-84	0-84	85-91	92-106	≥107	≥85		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Domain/Index score	**Acronym**	**% of TBI group**						**% of TBI group**				***M***	***SD***
Screening Attention Domain	S-ATT	3.1	3.1	0.0	6.3	15.6	28.1	21.9	21.9	28.1	71.9	92.8	16.5
Screening Language Domain	S-LAN	0.0	0.0	0.0	0.0	12.9	12.9	6.5	38.7	41.9	87.1	103.9	15.3
Screening Memory Domain	S-MEM	0.0	3.1	3.1	0.0	15.6	21.8	15.6	28.1	34.4	78.1	97.7	16.5
Screening Spatial Domain	S-SPT	0.0	0.0	0.0	3.1	9.4	12.5	12.5	31.3	43.8	87.6	104.5	16.0
Screening Executive Domain	S-EXE	3.1	3.1	3.1	9.4	3.1	21.8	12.5	59.4	6.3	78.2	91.2	14.2
Screening Total Index Domain	S-NAB	0.0	3.2	3.2	0.0	16.1	22.5	19.4	25.8	32.3	77.5	96.6	16.1
Attention Index	ATT	3.1	9.4	6.3	3.1	12.5	34.4	18.8	28.1	18.8	65.7	89.3	18.6
Language Index	LAN	0.0	0.0	0.0	0.0	13.8	13.8	10.3	65.5	10.3	86.1	96.1	9.3
Memory Index	MEM	0.0	0.0	6.3	0.0	18.8	25.1	9.4	43.8	21.9	75.1	96.2	17.2
Spatial Index	SPT	0.0	0.0	3.1	6.3	3.1	12.5	12.5	62.5	12.5	87.5	96.9	11.8
Executive Index	EXE	0.0	3.1	9.4	3.1	25.0	40.6	21.9	34.4	3.1	59.4	85.8	12.0
Total NAB Index	T-NAB	0.0	0.0	0.0	20.7	6.9	27.6	31.0	34.5	6.9	72.4	89.7	11.6

Note. $N = 31$.

Table 6.44
Percentage of Traumatic Brain Injury (TBI) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Screening Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of TBI group**						**% of TBI group**				***M***	***SD***
Screening Digits Forward	S-DGF	0.0	3.1	0.0	9.4	12.5	25.0	18.8	40.6	15.6	75.0	46.5	10.5
Screening Digits Backward	S-DGB	0.0	0.0	0.0	6.3	9.4	15.7	21.9	25.0	37.5	84.4	50.7	10.8
Screening Numbers & Letters Part A Speed	S-N&L$_A$–spd	6.3	3.1	3.1	12.5	9.4	34.4	9.4	25.0	31.3	65.7	45.7	14.4
Screening Numbers & Letters Part A Errors	S-N&L$_A$–err	3.1	0.0	0.0	6.3	3.1	12.5	12.5	75.0	0.0	87.5	47.4	8.2
Screening Numbers & Letters Part A Efficiency	S-N&L$_A$–eff	6.3	0.0	6.3	12.5	12.5	37.6	6.3	28.1	28.1	62.5	45.8	14.4
Screening Numbers & Letters Part B Efficiency	S-N&L$_B$–eff	3.1	6.3	6.3	3.1	12.5	31.3	12.5	40.6	15.6	68.7	43.9	11.8
Screening Auditory Comprehension	S-AUD	6.5	0.0	0.0	3.2	0.0	9.7	3.2	54.8	32.3	90.3	50.5	9.7
Screening Naming	S-NAM	6.3	0.0	0.0	0.0	0.0	6.3	0.0	34.4	59.4	93.8	53.6	9.6
Screening Shape Learning Immediate Recognition	S-SHL–irg	0.0	0.0	0.0	3.1	3.1	6.2	3.1	40.6	50.0	93.7	53.3	8.2
Screening Shape Learning Delayed Recognition	S-SHL–drg	0.0	0.0	3.1	0.0	9.4	12.5	12.5	43.8	31.3	87.6	50.9	9.2
Screening Story Learning Immediate Recall	S-STL–irc	3.1	3.1	6.3	3.1	3.1	18.7	18.8	25.0	37.5	81.3	46.9	12.2
Screening Story Learning Delayed Recall	S-STL–drc	3.1	0.0	3.1	9.4	15.6	31.2	18.8	31.3	18.8	68.9	45.2	12.1
Screening Visual Discrimination	S-VIS	0.0	0.0	0.0	3.1	6.3	9.4	6.3	21.9	62.5	90.7	52.8	8.4
Screening Design Construction	S-DES	0.0	0.0	6.3	3.1	6.3	15.7	18.8	18.8	46.9	84.5	51.6	11.8
Screening Mazes	S-MAZ	6.3	6.3	6.3	3.1	3.1	25.1	9.4	31.3	34.4	75.1	46.5	14.1
Screening Word Generation	S-WGN	0.0	0.0	6.3	3.1	15.6	25.0	25.0	40.6	9.4	75.0	44.1	7.1

Note. $N = 31$.

Table 6.45
Percentage of Traumatic Brain Injury (TBI) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Attention Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of TBI group**						**% of TBI group**				***M***	***SD***
Digits Forward	DGF	0.0	3.1	0.0	9.4	12.5	25.0	18.8	40.6	15.6	75.0	46.5	10.5
Digits Backward	DGB	0.0	0.0	0.0	6.3	9.4	15.7	21.9	25.0	37.5	84.4	50.7	10.8
Dots	DOT	3.1	0.0	0.0	12.5	9.4	25.0	28.1	28.1	18.8	75.0	46.0	11.3
Numbers & Letters Part A Speed	$N\&L_A$–spd	6.3	6.3	6.3	6.3	15.6	40.8	3.1	21.9	34.4	59.4	44.9	14.4
Numbers & Letters Part A Errors	$N\&L_A$–err	0.0	9.4	3.1	0.0	18.8	31.3	15.6	25.0	28.1	68.7	45.8	12.2
Numbers & Letters Part A Efficiency	$N\&L_A$–eff	9.4	3.1	9.4	9.4	9.4	40.7	3.1	25.0	31.3	59.4	43.8	14.4
Numbers & Letters Part B Efficiency	$N\&L_B$–eff	0.0	6.3	3.1	12.5	9.4	31.3	15.6	25.0	28.1	68.7	45.3	12.4
Numbers & Letters Part C Efficiency	$N\&L_C$–eff	0.0	0.0	0.0	12.5	12.5	25.0	18.8	43.8	12.5	75.1	45.6	8.5
Numbers & Letters Part D Efficiency	$N\&L_D$–eff	3.1	3.1	6.3	12.5	3.1	28.1	21.9	37.5	12.5	71.9	43.7	11.7
Numbers & Letters Part D Disruption	$N\&L_D$–dis	0.0	0.0	6.3	12.5	3.1	21.9	15.6	40.6	21.9	78.1	46.6	10.9
Driving Scenes	DRV	0.0	3.1	6.3	0.0	25.0	34.4	21.9	31.3	12.5	65.7	44.1	9.1

Note. $N = 31$.

Table 6.46
Percentage of Traumatic Brain Injury (TBI) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Language Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of TBI group**						**% of TBI group**				***M***	***SD***
Oral Production	OPD	0.0	0.0	0.0	9.7	0.0	9.7	32.3	38.7	19.4	90.4	46.7	7.6
Auditory Comprehension	AUD	0.0	0.0	3.4	0.0	0.0	3.4	3.4	58.6	34.5	96.5	51.6	6.0
Naming	NAM	0.0	0.0	0.0	0.0	6.5	6.5	3.2	48.4	41.9	93.5	52.8	5.2
Writing	WRT	3.2	3.2	3.2	0.0	3.2	12.8	6.5	48.4	32.3	87.2	48.5	10.1
Bill Payment	BIL	3.2	3.2	3.2	3.2	3.2	16.0	3.2	77.4	3.2	83.8	47.8	9.6

Note. $N = 31$.

Table 6.47
Percentage of Traumatic Brain Injury (TBI) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Memory Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of TBI group**						**% of TBI group**				***M***	***SD***
List Learning List A Immediate Recall	LLA–irc	0.0	0.0	6.3	6.3	21.9	34.5	6.3	34.4	25.0	65.7	45.5	11.0
List Learning List B Immediate Recall	LLB–irc	0.0	3.1	0.0	0.0	21.9	25.0	12.5	40.6	21.9	75.0	46.6	8.6
List Learning List A Short Delayed Recall	LLA–sd:drc	0.0	3.1	9.4	15.6	0.0	28.1	12.5	18.8	40.6	71.9	48.1	14.7
List Learning List A Long Delayed Recall	LLA–ld:drc	6.3	3.1	3.1	3.1	9.4	25.0	15.6	18.8	40.6	75.0	48.6	15.0
Shape Learning Immediate Recognition	SHL–irg	0.0	0.0	6.3	3.1	9.4	18.8	9.4	46.9	25.0	81.3	47.5	9.8
Shape Learning Delayed Recognition	SHL–drg	3.1	0.0	0.0	9.4	12.5	25.0	15.6	25.0	34.4	75.0	47.6	11.3
Story Learning Phrase Unit Immediate Recall	STL–irc:phu	0.0	3.1	0.0	0.0	12.5	15.6	15.6	34.4	34.4	84.4	49.8	10.1
Story Learning Phrase Unit Delayed Recall	STL–drc:phu	0.0	0.0	3.1	3.1	9.4	15.6	12.5	43.8	28.1	84.4	49.6	10.3
Daily Living Memory Immediate Recall	DLM–irc	3.1	0.0	3.1	3.1	9.4	18.7	0.0	40.6	40.6	81.2	51.8	11.7
Daily Living Memory Delayed Recall	DLM–drc	6.3	0.0	6.3	12.5	3.1	28.2	18.8	12.5	40.6	71.9	45.9	13.2

Note. $N = 31$.

Table 6.48
Percentage of Traumatic Brain Injury (TBI) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Spatial Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of TBI group**						**% of TBI group**				***M***	***SD***
Visual Discrimination	VIS	0.0	0.0	3.1	3.1	3.1	9.3	12.5	21.9	56.3	90.7	52.1	8.7
Design Construction	DES	0.0	0.0	0.0	3.1	6.3	9.4	18.8	37.5	34.4	90.7	50.7	9.7
Figure Drawing Copy	FGD–cpy	0.0	0.0	6.3	12.5	12.5	31.3	21.9	25.0	21.9	68.8	44.3	10.3
Figure Drawing Copy Organization	FGD–cpy:org	0.0	3.2	0.0	6.5	19.4	29.1	19.4	32.3	19.4	71.1	46.6	10.8
Figure Drawing Immediate Recall	FGD–irc	0.0	3.1	3.1	6.3	15.6	28.1	21.9	34.4	15.6	71.9	45.5	10.8
Map Reading	MAP	0.0	0.0	3.1	12.5	3.1	18.7	6.3	50.0	25.0	81.3	48.2	9.9

Note. $N = 31$.

Table 6.49
Percentage of Traumatic Brain Injury (TBI) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Executive Functions Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of TBI group**						**% of TBI group**				***M***	***SD***
Mazes	MAZ	3.1	3.1	0.0	9.4	3.1	18.7	12.5	31.3	37.5	81.3	48.7	11.9
Judgment	JDG	0.0	3.1	3.1	12.5	21.9	40.6	21.9	31.3	6.3	59.5	42.2	9.4
Categories	CAT	0.0	3.1	6.3	9.4	21.9	40.7	34.4	25.0	0.0	59.4	40.1	7.9
Word Generation	WGN	0.0	0.0	0.0	9.4	18.8	28.2	28.1	40.6	3.1	71.8	43.2	6.0

Note. $N = 31$.

cognitive complaints. Participants were excluded if English was not their primary language, or if they had visual or auditory acuity impairments or upper extremity motor disability severe enough to preclude standard administration procedures on the NAB. Other exclusion criteria included (a) current alcohol or other substance dependence/abuse, (b) history of loss of consciousness due to head trauma or anoxia, (c) history of previous or current other neurologic disorder with associated cognitive dysfunction (e.g., stroke, seizure disorder, encephalitis, MS, tumor), (d) major psychiatric illness (e.g., bipolar disorder, schizophrenia), or (e) known attention-deficit/hyperactivity disorder. Ten participants were diagnosed with AIDS, and nine were considered to have asymptomatic HIV infection without meeting criteria for AIDS. All but two participants were receiving highly active antiretroviral therapy (HAART) or similar HIV treatment at the time of their participation.

As shown in Table 6.50, the mean scores for the Screening Module ranged from 88.8 for the Screening Executive Functions Domain, to 102.2 for the Screening Language Domain, with a mean of 89.6 for the Total Screening Index. The module index mean scores ranged from 84.8 for the Attention Index, to 89.6 for the Language Index. The Total NAB Index mean score was 84.1. An evaluation of the total percentages of HIV patients with impaired performance reveals relatively high percentages of participants with impaired performance across the Screening Domain and module index scores. The total impaired percentages for the Screening Domain scores range from 21.1% for the Screening Language Domain to 42.1% for the Screening Executive Functions Domain score. The total impairment percentages for the main modules show a similar pattern. The percentages of total impaired for the module index scores range from 36.8% for the Language Module Index score to 57.9% for the Spatial Module Index score, with a Total NAB Index percentage of total impaired of 52.7%.

For the Screening Module (Table 6.51), the percentage of individuals obtaining primary scores in the impaired range spanned from 0.0% for Screening Naming (S-NAM) to 36.9% for Screening Word Generation (S-WGN). As shown in Table 6.52, the percentage of scores in the impaired ranges for the Attention Module spanned from 21.1% for Numbers & Letters Part A Speed ($N\&L_A$–spd) and Numbers & Letters Part C Efficiency ($N\&L_C$–eff) to 63.2% for Driving Scenes (DRV). On the remaining NAB modules, percentages of primary scores in the impaired range spanned from 21.1% to 36.8% for the Language Module (see Table 6.53), from 21.1% to 63.1% for the Memory Module (see Table 6.54), from 15.8% to 47.5% for the Spatial Module (see Table 6.55), and from 21.0% to 31.6% for the Executive Functions Module (see Table 6.56).

Multiple Sclerosis

Multiple sclerosis (MS) is a chronic demyelinating disease thought to be due to an underlying autoimmune disorder. Neuropsychological deficits are common in MS and can frequently result in reduced functional independence as well as diminished quality of life (Benito-Leon, Morales, & Rivera-Navarro, 2002). Most of the neuropsychological deficits in MS are thought to be secondary to the subcortical white matter lesions caused by demyelination. These include diminished attention, slowed information processing and psychomotor speed, difficulties with encoding and free recall in new learning, some difficulties with visuospatial skills, and problems with aspects of executive functions (Rao, 1995).

To examine the effect of MS on NAB performance, a study was conducted with 31 outpatients diagnosed with MS who were referred by their treating neurologists. The 31 participants ranged in age from 24 to 59 years (M = 43.4 years, SD = 9.9 years). The percentages of the sample by education level were 10% with ≤11 years of education, 23% with 12 years, 38% with 13 to 15 years, and 29% with ≥16 years. The average level of education was 14.1 years (SD = 3.1 years). The study consisted of 77% females and 23% males, and the ethnicity of the entire sample was Caucasian.

Referrals were not made on the basis of cognitive complaints or previous neuropsychological findings. MS diagnoses were confirmed by the referring neurologists. Participants were excluded if English was not their primary language or if they had visual or auditory acuity impairments or upper extremity motor disability severe enough to preclude standard administration procedures on the NAB. Other exclusion criteria included (a) current alcohol or other substance dependence/abuse, (b) history of loss of consciousness due to head trauma or anoxia, (c) history of previous or current other neurologic disorder with associated cognitive dysfunction (e.g., stroke, dementia, seizure disorder, encephalitis, tumor), (d) major psychiatric illness (e.g., bipolar disorder, schizophrenia), or (e) known attention-deficit/hyperactivity disorder. Of the 31 study participants, 23 were considered to have the relapsing/remitting form of MS, 1 had primary progressive, 6 had secondary progressive, and for 1 participant, the subtype was unclear.

As shown in Table 6.57, the mean scores for the Screening Domain ranged from 84.0 for the Screening Executive Functions Domain to 102.1 for the Screening Language Domain, with a mean of 86.3 for the Total Screening Index. The module index mean scores ranged from 79.8 for the Attention Index, to 92.2 for the Language Index. The Total NAB Index mean score was 83.3. An evaluation of the total percentages of those study participants with impaired NAB performance reveals relatively

Table 6.50
Percentage of Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS) Sample Scoring Within Suggested Clinically Relevant Standard Score Ranges for the Screening Domain and NAB Index Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
Standard score range		0-54	55-61	62-69	70-76	77-84	0-84	85-91	92-106	≥107	≥85		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Domain/Index score	**Acronym**	**% of HIV/AIDS group**						**% of HIV/AIDS group**				***M***	***SD***
Screening Attention Domain	S-ATT	0.0	5.3	5.3	10.5	10.5	31.6	26.3	21.1	21.1	68.5	91.5	18.0
Screening Language Domain	S-LAN	0.0	0.0	0.0	0.0	21.1	21.1	0.0	42.1	36.8	78.9	102.2	12.0
Screening Memory Domain	S-MEM	0.0	5.3	0.0	5.3	15.8	26.4	31.6	26.3	15.8	73.7	91.4	15.3
Screening Spatial Domain	S-SPT	0.0	5.3	5.3	5.3	10.5	26.4	31.6	26.3	15.8	73.7	92.3	16.7
Screening Executive Functions Domain	S-EXE	0.0	0.0	5.3	26.3	10.5	42.1	15.8	31.6	10.5	57.9	88.8	15.0
Total Screening Index	S-NAB	0.0	5.3	10.5	10.5	10.5	36.8	10.5	36.8	15.8	63.1	89.6	17.4
Attention Index	ATT	5.3	0.0	10.5	15.8	15.8	47.4	15.8	26.3	10.5	52.6	84.8	15.4
Language Index	LAN	0.0	0.0	15.8	10.5	10.5	36.8	21.1	21.1	21.1	63.3	89.6	16.4
Memory Index	MEM	0.0	5.3	5.3	15.8	26.3	52.7	15.8	15.8	15.8	47.4	87.0	16.7
Spatial Index	SPT	0.0	0.0	5.3	15.8	36.8	57.9	5.3	21.1	15.8	42.2	87.4	16.1
Executive Functions Index	EXE	0.0	5.3	10.5	5.3	21.1	42.2	31.6	15.8	10.5	57.9	87.2	14.9
Total NAB Index	T-NAB	0.0	5.3	15.8	10.5	21.1	52.7	21.1	15.8	10.5	47.4	84.1	15.8

Note. $N = 19$.

Table 6.51
Percentage of Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Screening Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of HIV/AIDS group**						**% of HIV/AIDS group**				***M***	***SD***
Screening Digits Forward	S-DGF	0.0	0.0	5.3	5.3	15.8	26.4	26.3	26.3	21.1	73.7	46.2	11.0
Screening Digits Backward	S-DGB	0.0	0.0	10.5	5.3	10.5	26.3	15.8	36.8	21.1	73.7	46.5	10.8
Screening Numbers & Letters Part A Speed	S-N&L_A–spd	0.0	0.0	0.0	5.3	15.8	21.1	42.1	36.8	0.0	78.9	44.1	6.0
Screening Numbers & Letters Part A Errors	S-N&L_A–err	0.0	0.0	0.0	5.3	10.5	15.8	5.3	73.7	5.3	84.3	49.6	7.4
Screening Numbers & Letters Part A Efficiency	S-N&L_A–eff	0.0	0.0	0.0	5.3	10.5	15.8	47.4	31.6	5.3	84.3	44.5	6.6
Screening Numbers & Letters Part B Efficiency	S-N&L_B–eff	0.0	0.0	5.3	10.5	15.8	31.6	10.5	26.3	31.6	68.4	47.8	13.4
Screening Auditory Comprehension	S-AUD	15.8	0.0	5.3	0.0	0.0	21.1	0.0	36.8	42.1	78.9	47.5	13.9
Screening Naming	S-NAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.8	84.2	100.0	55.3	0.9
Screening Shape Learning Immediate Recognition	S-SHL–irg	0.0	0.0	5.3	0.0	10.5	15.8	21.1	26.3	36.8	84.2	48.5	9.9
Screening Shape Learning Delayed Recognition	S-SHL–drg	0.0	0.0	0.0	10.5	15.8	26.3	10.5	31.6	31.6	73.7	47.6	9.7
Screening Story Learning Immediate Recall	S-STL–irc	0.0	5.3	5.3	5.3	15.8	31.7	21.1	31.6	15.8	68.5	44.0	11.2
Screening Story Learning Delayed Recall	S-STL–drc	0.0	10.5	5.3	0.0	10.5	26.3	31.6	26.3	15.8	73.7	44.1	11.9
Screening Visual Discrimination	S-VIS	5.3	0.0	5.3	15.8	0.0	26.4	0.0	42.1	31.6	73.7	46.3	12.3
Screening Design Construction	S-DES	0.0	0.0	0.0	15.8	15.8	31.6	5.3	47.4	15.8	68.5	45.4	9.6
Screening Mazes	S-MAZ	0.0	5.3	5.3	15.8	0.0	26.4	26.3	10.5	36.8	73.6	45.3	12.1
Screening Word Generation	S-WGN	0.0	0.0	5.3	10.5	21.1	36.9	21.1	31.6	10.5	63.2	42.9	8.5

Note. $N = 19$.

Table 6.52
Percentage of Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Attention Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of HIV/AIDS group**						**% of HIV/AIDS group**				***M***	***SD***
Digits Forward	DGF	0.0	0.0	5.3	5.3	15.8	26.4	26.3	26.3	21.1	73.7	46.2	11.0
Digits Backward	DGB	0.0	0.0	10.5	5.3	10.5	26.3	15.8	36.8	21.1	73.7	46.5	10.8
Dots	DOT	0.0	10.5	5.3	0.0	15.8	31.6	15.8	31.6	21.1	68.5	43.9	12.5
Numbers & Letters Part A Speed	$N\&L_A$–spd	0.0	0.0	0.0	5.3	15.8	21.1	36.8	26.3	15.8	78.9	45.1	6.7
Numbers & Letters Part A Errors	$N\&L_A$–err	0.0	5.3	0.0	5.3	15.8	26.4	10.5	26.3	36.8	73.6	48.5	11.8
Numbers & Letters Part A Efficiency	$N\&L_A$–eff	0.0	0.0	0.0	15.8	10.5	26.3	31.6	26.3	15.8	73.7	43.9	7.2
Numbers & Letters Part B Efficiency	$N\&L_B$–eff	0.0	0.0	0.0	10.5	21.1	31.6	31.6	31.6	5.3	68.5	44.1	7.4
Numbers & Letters Part C Efficiency	$N\&L_C$–eff	0.0	0.0	0.0	5.3	15.8	21.1	26.3	42.1	10.5	78.9	46.0	7.4
Numbers & Letters Part D Efficiency	$N\&L_D$–eff	0.0	0.0	5.3	5.3	15.8	26.4	26.3	31.6	15.8	73.7	44.1	8.8
Numbers & Letters Part D Disruption	$N\&L_D$–dis	0.0	0.0	0.0	5.3	21.1	26.4	5.3	31.6	36.8	73.7	48.4	8.4
Driving Scenes	DRV	0.0	15.8	5.3	31.6	10.5	63.2	15.8	15.8	5.3	36.9	36.5	11.5

Note. $N = 19$.

Table 6.53
Percentage of Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Language Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of HIV/AIDS group**						**% of HIV/AIDS group**				***M***	***SD***
Oral Production	OPD	0.0	0.0	0.0	26.3	10.5	36.8	15.8	31.6	15.8	63.2	43.9	10.4
Auditory Comprehension	AUD	10.5	5.3	10.5	0.0	0.0	26.3	5.3	26.3	42.1	73.7	46.1	14.9
Naming	NAM	5.3	0.0	5.3	0.0	10.5	21.1	10.5	47.4	21.1	79.0	47.3	10.6
Writing	WRT	0.0	0.0	5.3	10.5	15.8	31.6	0.0	26.3	42.1	68.4	46.9	10.4
Bill Payment	BIL	5.3	10.5	5.3	5.3	5.3	31.7	15.8	42.1	10.5	68.4	43.2	13.2

Note. $N = 19$.

Table 6.54
Percentage of Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Memory Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of HIV/AIDS group**						**% of HIV/AIDS group**				***M***	***SD***
List Learning List A Immediate Recall	LLA–irc	0.0	5.3	5.3	5.3	10.5	26.4	36.8	31.6	5.3	73.7	43.5	8.9
List Learning List B Immediate Recall	LLB–irc	0.0	0.0	10.5	26.3	26.3	63.1	5.3	10.5	21.1	36.9	41.2	11.3
List Learning List A Short Delayed Recall	LLA–sd:drc	5.3	0.0	5.3	0.0	10.5	21.1	31.6	36.8	10.5	78.9	43.9	10.0
List Learning List A Long Delayed Recall	LLA–ld:drc	0.0	21.1	0.0	5.3	15.8	42.2	26.3	15.8	15.8	57.9	42.0	14.8
Shape Learning Immediate Recognition	SHL–irg	5.3	0.0	10.5	10.5	26.3	52.6	5.3	26.3	15.8	47.4	41.3	11.4
Shape Learning Delayed Recognition	SHL–drg	0.0	5.3	5.3	0.0	31.6	42.2	5.3	31.6	21.1	58.0	44.6	11.9
Story Learning Phrase Unit Immediate Recall	STL–irc:phu	0.0	5.3	0.0	15.8	21.1	42.2	10.5	15.8	31.6	57.9	44.7	12.3
Story Learning Phrase Unit Delayed Recall	STL–drc:phu	0.0	0.0	5.3	26.3	21.1	52.7	10.5	31.6	5.3	47.4	41.4	8.5
Daily Living Memory Immediate Recall	DLM–irc	0.0	0.0	0.0	10.5	15.8	26.3	15.8	26.3	31.6	73.7	47.9	10.9
Daily Living Memory Delayed Recall	DLM–drc	5.3	10.5	5.3	5.3	15.8	42.2	10.5	10.5	36.8	57.8	44.2	14.8

Note. $N = 19$.

Table 6.55
Percentage of Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Spatial Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of HIV/AIDS group**						**% of HIV/AIDS group**				***M***	***SD***
Visual Discrimination	VIS	0.0	10.5	0.0	10.5	15.8	36.8	21.1	26.3	15.8	63.2	42.7	11.0
Design Construction	DES	0.0	0.0	5.3	10.5	15.8	31.6	26.3	26.3	15.8	68.4	44.1	10.1
Figure Drawing Copy	FGD−cpy	0.0	5.3	5.3	15.8	21.1	47.5	0.0	31.6	21.1	52.7	43.7	12.8
Figure Drawing Copy Organization	FGD−cpy:org	0.0	0.0	0.0	10.5	5.3	15.8	15.8	47.4	21.1	84.3	48.4	9.5
Figure Drawing Immediate Recall	FGD−irc	0.0	0.0	0.0	15.8	31.6	47.4	10.5	26.3	15.8	52.6	42.9	8.9
Map Reading	MAP	0.0	0.0	5.3	26.3	5.3	36.9	15.8	26.3	21.1	63.2	44.9	12.6

Note. $N = 19$.

Table 6.56
Percentage of Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Executive Functions Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of HIV/AIDS group**						**% of HIV/AIDS group**				***M***	***SD***
Mazes	MAZ	0.0	0.0	0.0	10.5	10.5	21.0	26.3	31.6	21.1	79.0	45.9	8.7
Judgment	JDG	0.0	0.0	5.3	5.3	21.1	31.6	15.8	42.1	10.5	68.4	44.9	8.0
Categories	CAT	0.0	5.3	5.3	15.8	5.3	31.6	15.8	42.1	10.5	68.4	43.4	10.2
Word Generation	WGN	0.0	5.3	5.3	10.5	5.3	26.3	31.6	31.6	10.5	73.7	42.9	9.9

Note. $N = 19$.

Table 6.57
Percentage of Multiple Sclerosis (MS) Sample Scoring Within Suggested Clinically Relevant Standard Score Ranges for the Screening Domain and NAB Index Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
Standard score range		0-54	55-61	62-69	70-76	77-84	0-84	85-91	92-106	≥107	≥85		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Domain/Index score	**Acronym**	**% of MS group**						**% of MS group**				***M***	***SD***
Screening Attention Domain	S-ATT	3.2	12.9	9.7	6.5	25.8	58.1	6.5	19.4	16.1	42.0	84.8	20.6
Screening Language Domain	S-LAN	0.0	0.0	0.0	0.0	9.7	9.7	12.9	41.9	35.5	90.3	102.1	12.3
Screening Memory Domain	S-MEM	0.0	3.2	6.5	3.2	16.1	29.0	22.6	38.7	9.7	71.0	90.6	14.1
Screening Spatial Domain	S-SPT	0.0	0.0	6.5	12.9	12.9	32.3	12.9	35.5	19.4	67.8	92.7	16.8
Screening Executive Functions Domain	S-EXE	0.0	12.9	3.2	25.8	9.7	51.6	19.4	16.1	12.9	48.4	84.0	17.3
Total Screening Index	S-NAB	0.0	3.2	19.4	12.9	9.7	45.2	16.1	22.6	16.1	54.8	86.3	17.6
Attention Index	ATT	12.9	12.9	9.7	3.2	19.4	58.1	12.9	19.4	9.7	42.0	79.8	19.5
Language Index	LAN	0.0	0.0	0.0	9.7	9.7	19.4	38.7	32.3	9.7	80.7	92.2	11.1
Memory Index	MEM	3.2	3.2	9.7	12.9	29.0	58.0	6.5	12.9	22.6	42.0	86.0	18.0
Spatial Index	SPT	0.0	0.0	6.5	19.4	22.6	48.5	9.7	29.0	12.9	51.6	88.0	14.7
Executive Functions Index	EXE	3.2	6.5	12.9	3.2	16.1	41.9	29.0	19.4	9.7	58.1	85.8	17.0
Total NAB Index	T-NAB	3.2	0.0	19.4	12.9	19.4	54.9	16.1	22.6	6.5	45.2	83.3	15.2

Note. $N = 31$.

high percentages of participants with NAB scores in the impaired range across both the Screening Domain and module index scores. No appreciable impairment is noted for the Screening Language Domain score. In other areas, however, the total impaired percentages range from 29.0% for the Screening Memory Domain score to 58.1% for the Screening Attention Domain score. The percentages of module index scores in the impaired range show a similar pattern, with a relatively low percentage of Language Index scores in the impaired range but elevated percentages of scores in the impaired range for the other module index scores. Over 50% of the study participants obtained scores in the impaired range for the Attention Index and memory index scores, as well as the Total NAB Index score.

Performance on the Screening Module primary scores (see Table 6.58) is mostly within 1 *SD* of the standardization group normative mean. The percentages of scores in the impaired ranges span from 3.2% for Screening Auditory Comprehension (S-AUD) to 54.9% for Screening Numbers & Letters Part B Efficiency (S-N&L_B–eff) and Screening Word Generation (S-WGN). An examination of the Attention Module primary scores (see Table 6.59) reveals a high percentage of impaired performance for most scores. Relative to the other modules, only one Language Module primary score (Oral Production) showed an appreciable elevated percentage of impairment (41.9%, see Table 6.60). Tables 6.61 to 6.63 show consistently higher percentages of impaired performance than would be expected in the general population. The primary scores in these modules demonstrate a greater percentage of impaired functioning in memory, spatial, and executive functions tasks.

Adult Attention-Deficit/Hyperactivity Disorder

Attention-deficit/hyperactivity disorder (ADHD) in adults is increasingly recognized as a common disorder (Schweitzer, Cummins, & Kant, 2001), with the neuropsychological evaluation playing an important role in the diagnosis of adult ADHD (Gallagher & Blader, 2001). Reviews of the literature indicate that adults with ADHD demonstrate a variety of subtle impairments on measures of attention, working memory, verbal list learning, information processing speed, and executive functions, including poor organization, disinhibition, and reduced cognitive response set (Schreiber, Javorsky, Robinson, & Stern, 2000; Woods, Lovejoy, & Ball, 2002).

To examine the effects of ADHD on NAB performance, a study was conducted with participants (n = 30) who were previously diagnosed with ADHD by a neuropsychologist, neurologist, or psychiatrist using *DSM-IV-TR* criteria. The 30 participants ranged in age from 18 to 59 years (M = 30.7 years, SD = 13.3 years). The percentages of the sample by education level were 7% with ≤11 years of education, 40% with 12 years, 24% with 13 to 15 years, and 29% with ≥16 years. The average level of education was 13.3 years (SD = 1.7 years). The study consisted of 53% females and 47% males, and the ethnicity of the entire sample was Caucasian.

Participants were excluded if English was not their primary language or if they had visual or auditory acuity impairments or upper extremity motor disability severe enough to preclude standard NAB administration procedures. Other exclusion criteria included (a) current alcohol or other substance dependence/abuse, (b) history of loss of consciousness due to head trauma or anoxia, (c) history of previous or current other neurologic disorder with associated cognitive dysfunction (e.g., stroke, seizure disorder, encephalitis, MS, tumor), or (d) major psychiatric illness (e.g., bipolar disorder, schizophrenia). Although the majority of participants (63%) were taking stimulant medication, some (10%) were taking other medications prescribed specifically for the treatment of their ADHD (e.g., bupropion), and several (27%) were not taking any medications. All participants who were prescribed medication for their ADHD took no dose prior to testing on the day of their study participation. All participants were administered the entire NAB.

Table 6.64 presents the descriptive statistics and impairment percentages for the Screening Domain and module index scores. The Screening Domain mean scores were quite variable, with the Screening Language Domain score being the highest (112.1). The lowest group mean score occurred on the Screening Executive Functions Domain (90.0). The module index mean scores ranged from 88.8 for the Attention Index to 98.7 for the Spatial Index. As expected, the greatest percentages of impaired performance were in the areas of attention and executive functioning. Tables 6.65 to 6.70 present the NAB scores for the Screening Module and the five main modules. Of the Attention Module primary scores (see Table 6.66), those involving speeded performance generally show the highest impairment percentages. Similar to the module index scores, the Attention Module and Executive Functions Module primary scores exhibited the greatest percentages of individuals who scored in the impaired range, a finding consistent with the research literature on attention-deficit/hyperactivity disorder (Woods et al., 2002).

Rehabilitation Inpatients

Neuropsychological evaluations are commonly performed in both acute and postacute inpatient rehabilitation settings in order to describe and define the patient's cognitive strengths and weaknesses, as well as to guide treatment planning (Sohlberg & Mateer, 2001). However, comprehensive evaluations are frequently inappropriate in this setting,

Table 6.58
Percentage of Multiple Sclerosis (MS) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Screening Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of MS group**						**% of MS group**				***M***	***SD***
Screening Digits Forward	S-DGF	3.2	0.0	3.2	9.7	22.6	38.7	19.4	22.6	19.4	61.4	44.0	10.7
Screening Digits Backward	S-DGB	0.0	3.2	3.2	9.7	9.7	25.8	16.1	35.5	22.6	74.2	46.5	11.0
Screening Numbers & Letters Part A Speed	S-N&L$_A$–spd	12.9	12.9	3.2	9.7	6.5	45.2	16.1	22.6	16.1	54.8	39.2	14.5
Screening Numbers & Letters Part A Errors	S-N&L$_A$–err	6.5	3.2	6.5	12.9	0.0	29.1	3.2	67.7	0.0	70.9	43.5	11.6
Screening Numbers & Letters Part A Efficiency	S-N&L$_A$–eff	12.9	12.9	3.2	6.5	12.9	48.4	16.1	19.4	16.1	51.6	39.0	14.6
Screening Numbers & Letters Part B Efficiency	S-N&L$_B$–eff	3.2	3.2	6.5	22.6	19.4	54.9	9.7	9.7	25.8	45.2	42.8	15.8
Screening Auditory Comprehension	S-AUD	3.2	0.0	0.0	0.0	0.0	3.2	6.5	45.2	45.2	96.9	52.0	7.1
Screening Naming	S-NAM	0.0	0.0	6.5	0.0	6.5	13.0	0.0	32.3	54.8	87.1	52.1	8.9
Screening Shape Learning Immediate Recognition	S-SHL–irg	0.0	0.0	3.2	9.7	3.2	16.1	16.1	38.7	29.0	83.8	48.0	9.2
Screening Shape Learning Delayed Recognition	S-SHL–drg	0.0	0.0	16.1	0.0	22.6	38.7	3.2	32.3	25.8	61.3	44.5	11.2
Screening Story Learning Immediate Recall	S-STL–irc	0.0	3.2	6.5	6.5	6.5	22.7	19.4	32.3	25.8	77.5	46.7	11.3
Screening Story Learning Delayed Recall	S-STL–drc	0.0	0.0	6.5	19.4	3.2	29.1	16.1	38.7	16.1	70.9	43.7	10.3
Screening Visual Discrimination	S-VIS	3.2	6.5	6.5	9.7	3.2	29.1	12.9	6.5	51.6	71.0	46.8	13.9
Screening Design Construction	S-DES	0.0	6.5	3.2	3.2	22.6	35.5	12.9	29.0	22.6	64.5	45.1	12.0
Screening Mazes	S-MAZ	9.7	0.0	9.7	16.1	16.1	51.6	3.2	29.0	16.1	48.3	41.5	13.5
Screening Word Generation	S-WGN	0.0	3.2	6.5	19.4	25.8	54.9	12.9	19.4	12.9	45.2	40.8	10.0

Note. $N = 31$.

Table 6.59
Percentage of Multiple Sclerosis (MS) Sample Within Suggested Clinically Relevant *T*-Score Ranges for the Attention Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of MS group**						**% of MS group**				***M***	***SD***
Digits Forward	DGF	3.2	0.0	3.2	9.7	22.6	38.7	19.4	22.6	19.4	61.4	44.0	10.7
Digits Backward	DGB	0.0	3.2	3.2	9.7	9.7	25.8	16.1	35.5	22.6	74.2	46.5	11.0
Dots	DOT	0.0	3.2	3.2	25.8	6.5	38.7	6.5	32.3	22.6	61.4	44.0	11.5
Numbers & Letters Part A Speed	$N\&L_A$–spd	16.1	9.7	3.2	9.7	12.9	51.6	9.7	16.1	22.6	48.4	39.3	14.6
Numbers & Letters Part A Errors	$N\&L_A$–err	9.7	3.2	3.2	12.9	9.7	38.7	12.9	32.3	16.1	61.3	42.2	13.1
Numbers & Letters Part A Efficiency	$N\&L_A$–eff	19.4	3.2	6.5	19.4	6.5	55.0	9.7	25.8	9.7	45.2	37.5	14.0
Numbers & Letters Part B Efficiency	$N\&L_B$–eff	3.2	6.5	12.9	6.5	19.4	48.5	3.2	32.3	16.1	51.6	41.9	13.4
Numbers & Letters Part C Efficiency	$N\&L_C$–eff	0.0	0.0	6.5	16.1	19.4	42.0	19.4	22.6	16.1	58.1	44.1	11.6
Numbers & Letters Part D Efficiency	$N\&L_D$–eff	6.5	6.5	12.9	16.1	25.8	67.8	6.5	19.4	6.5	32.4	37.5	11.1
Numbers & Letters Part D Disruption	$N\&L_D$–dis	0.0	3.2	3.2	9.7	12.9	29.0	12.9	29.0	29.0	70.9	47.5	12.2
Driving Scenes	DRV	6.5	0.0	9.7	12.9	22.6	51.7	29.0	12.9	6.5	48.4	38.1	9.2

Note. $N = 31$.

Table 6.60
Percentage of Multiple Sclerosis (MS) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Language Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of MS group**						**% of MS group**				***M***	***SD***
Oral Production	OPD	0.0	3.2	0.0	16.1	22.6	41.9	12.9	29.0	16.1	58.0	44.7	11.6
Auditory Comprehension	AUD	6.5	0.0	6.5	3.2	3.2	19.4	3.2	45.2	32.3	80.7	47.6	11.4
Naming	NAM	0.0	0.0	3.2	0.0	6.5	9.7	9.7	45.2	35.5	90.4	51.4	7.1
Writing	WRT	0.0	3.2	3.2	3.2	6.5	16.1	12.9	61.3	9.7	83.9	47.4	8.9
Bill Payment	BIL	3.2	3.2	6.5	0.0	3.2	16.1	9.7	67.7	6.5	83.9	46.2	10.0

Note. $N = 31$.

Table 6.61
Percentage of Multiple Sclerosis (MS) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Memory Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of MS group**						**% of MS group**				***M***	***SD***
List Learning List A Immediate Recall	LLA–irc	0.0	6.5	9.7	16.1	6.5	38.8	12.9	35.5	12.9	61.3	42.5	11.5
List Learning List B Immediate Recall	LLB–irc	3.2	3.2	3.2	12.9	12.9	35.4	16.1	41.9	6.5	64.5	42.8	10.6
List Learning List A Short Delayed Recall	LLA–sd:drc	0.0	0.0	12.9	12.9	9.7	35.5	9.7	35.5	19.4	64.6	44.2	11.7
List Learning List A Long Delayed Recall	LLA–ld:drc	0.0	6.5	9.7	6.5	19.4	42.1	9.7	29.0	19.4	58.1	42.5	11.4
Shape Learning Immediate Recognition	SHL–irg	3.2	6.5	9.7	12.9	25.8	58.1	9.7	19.4	12.9	42.0	40.7	12.7
Shape Learning Delayed Recognition	SHL–drg	0.0	12.9	3.2	6.5	19.4	42.0	12.9	35.5	9.7	58.1	42.2	11.9
Story Learning Phrase Unit Immediate Recall	STL–irc:phu	3.2	0.0	0.0	3.2	16.1	22.5	29.0	22.6	25.8	77.4	46.1	10.3
Story Learning Phrase Unit Delayed Recall	STL–drc:phu	0.0	0.0	3.2	19.4	16.1	38.7	16.1	19.4	25.8	61.3	45.0	10.3
Daily Living Memory Immediate Recall	DLM–irc	3.2	0.0	3.2	9.7	12.9	29.0	22.6	29.0	19.4	71.0	45.1	11.6
Daily Living Memory Delayed Recall	DLM–drc	9.7	12.9	3.2	9.7	16.1	51.6	9.7	9.7	29.0	48.4	40.1	14.0

Note. $N = 31$.

Table 6.62
Percentage of Multiple Sclerosis (MS) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Spatial Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of MS group**						**% of MS group**				***M***	***SD***
Visual Discrimination	VIS	3.2	6.5	6.5	3.2	25.8	45.2	9.7	22.6	22.6	54.9	42.6	12.5
Design Construction	DES	0.0	6.5	16.1	3.2	12.9	38.7	12.9	29.0	19.4	61.3	43.7	12.9
Figure Drawing Copy	FGD–cpy	0.0	9.7	3.2	3.2	16.1	32.2	6.5	25.8	35.5	67.8	46.8	13.1
Figure Drawing Copy Organization	FGD–cpy:org	0.0	0.0	6.7	6.7	13.3	26.7	10.0	30.0	33.3	73.3	48.9	12.0
Figure Drawing Immediate Recall	FGD–irc	3.2	3.2	6.5	16.1	3.2	32.2	22.6	25.8	19.4	67.8	44.6	14.0
Map Reading	MAP	0.0	0.0	9.7	6.5	22.6	38.8	16.1	35.5	9.7	61.3	44.2	10.7

Note. $N = 31$.

Table 6.63
Percentage of Multiple Sclerosis (MS) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Executive Functions Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of MS group**						**% of MS group**				***M***	***SD***
Mazes	MAZ	3.2	12.9	6.5	3.2	9.7	35.5	25.8	19.4	19.4	64.6	41.9	12.9
Judgment	JDG	0.0	0.0	0.0	3.2	19.4	22.6	35.5	19.4	22.6	77.5	45.5	8.2
Categories	CAT	0.0	3.2	3.2	6.5	22.6	35.5	9.7	45.2	9.7	64.6	44.3	9.5
Word Generation	WGN	3.2	6.5	3.2	9.7	12.9	35.5	19.4	29.0	16.1	64.5	42.4	10.7

Note. $N = 31$.

Table 6.64
Percentage of Attention-Deficit/Hyperactivity Disorder (ADHD) Sample Scoring Within Suggested Clinically Relevant Standard Score Ranges for the Screening Domain and NAB Index Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
Standard score range		0-54	55-61	62-69	70-76	77-84	0-84	85-91	92-106	≥107	≥85		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Domain/Index score	**Acronym**	**% of ADHD group**						**% of ADHD group**				***M***	***SD***
Screening Attention Domain	S-ATT	0.0	3.3	3.3	3.3	23.3	33.2	16.7	33.3	16.7	66.7	91.3	14.6
Screening Language Domain	S-LAN	0.0	0.0	0.0	0.0	16.7	16.7	0.0	13.3	70.0	83.3	112.1	17.3
Screening Memory Domain	S-MEM	0.0	0.0	0.0	3.4	10.3	13.7	17.2	48.3	20.7	86.2	97.1	11.6
Screening Spatial Domain	S-SPT	0.0	3.3	0.0	0.0	3.3	6.6	10.0	30.0	53.3	93.3	107.3	16.5
Screening Executive Functions Domain	S-EXE	3.3	3.3	6.7	3.3	20.0	36.6	10.0	40.0	13.3	63.3	90.0	16.8
Total Screening Index	S-NAB	0.0	0.0	0.0	3.4	10.3	13.7	17.2	31.0	37.9	86.1	100.7	13.5
Attention Index	ATT	0.0	6.7	0.0	6.7	26.7	40.1	23.3	30.0	6.7	60.0	88.8	13.3
Language Index	LAN	0.0	0.0	3.3	3.3	13.3	19.9	16.7	50.0	13.3	80.0	95.5	12.3
Memory Index	MEM	0.0	0.0	0.0	3.3	23.3	26.6	6.7	53.3	13.3	73.3	95.1	12.6
Spatial Index	SPT	0.0	0.0	3.3	3.3	10.0	16.6	23.3	30.0	30.0	83.3	98.7	15.6
Executive Functions Index	EXE	0.0	3.4	6.9	3.4	20.7	34.4	20.7	34.5	10.3	65.5	90.2	14.4
Total NAB Index	T-NAB	0.0	0.0	3.4	3.4	17.2	24.0	31.0	34.5	10.3	75.8	92.0	12.5

Note. $N = 30$.

Table 6.65
Percentage of Attention-Deficit/Hyperactivity Disorder (ADHD) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Screening Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of ADHD group**						**% of ADHD group**				***M***	***SD***
Screening Digits Forward	S-DGF	0.0	0.0	0.0	6.7	26.7	33.4	10.0	20.0	36.7	66.7	47.9	10.3
Screening Digits Backward	S-DGB	0.0	0.0	6.7	6.7	3.3	16.7	10.0	43.3	30.0	83.3	48.7	11.0
Screening Numbers & Letters Part A Speed	S-N&L$_A$–spd	3.3	0.0	0.0	16.7	13.3	33.3	16.7	26.7	23.3	66.7	45.1	11.5
Screening Numbers & Letters Part A Errors	S-N&L$_A$–err	0.0	3.3	0.0	6.7	0.0	10.0	3.3	86.7	0.0	90.0	47.7	7.7
Screening Numbers & Letters Part A Efficiency	S-N&L$_A$–eff	3.3	0.0	0.0	16.7	10.0	30.0	16.7	30.0	23.3	70.0	45.6	10.9
Screening Numbers & Letters Part B Efficiency	S-N&L$_B$–eff	6.7	0.0	6.7	16.7	0.0	30.1	26.7	30.0	13.3	70.0	42.2	10.9
Screening Auditory Comprehension	S-AUD	10.0	0.0	3.3	0.0	0.0	13.3	0.0	56.7	30.0	86.7	49.5	11.5
Screening Naming	S-NAM	0.0	0.0	3.3	0.0	0.0	3.3	0.0	13.3	83.3	96.6	57.6	6.9
Screening Shape Learning Immediate Recognition	S-SHL–irg	0.0	0.0	6.7	3.3	13.3	23.3	23.3	26.7	26.7	76.7	47.7	10.5
Screening Shape Learning Delayed Recognition	S-SHL–drg	0.0	0.0	0.0	0.0	10.3	10.3	3.4	58.6	27.6	89.6	51.3	7.1
Screening Story Learning Immediate Recall	S-STL–irc	0.0	0.0	0.0	6.7	10.0	16.7	20.0	33.3	30.0	83.3	48.7	9.8
Screening Story Learning Delayed Recall	S-STL–drc	0.0	3.3	0.0	6.7	6.7	16.7	20.0	43.3	20.0	83.3	47.0	9.6
Screening Visual Discrimination	S-VIS	3.3	3.3	0.0	3.3	0.0	9.9	10.0	6.7	73.3	90.0	52.8	11.5
Screening Design Construction	S-DES	0.0	0.0	3.3	6.7	0.0	10.0	0.0	43.3	46.7	90.0	54.3	10.4
Screening Mazes	S-MAZ	10.0	0.0	3.3	10.0	6.7	30.0	10.0	23.3	36.7	70.0	45.2	12.8
Screening Word Generation	S-WGN	0.0	3.3	6.7	13.3	10.0	33.3	10.0	43.3	13.3	66.6	44.0	10.7

Note. $N = 30$.

Table 6.66

Percentage of Attention-Deficit/Hyperactivity Disorder (ADHD) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Attention Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of ADHD group**						**% of ADHD group**				***M***	***SD***
Digits Forward	DGF	0.0	0.0	0.0	6.7	26.7	33.4	10.0	20.0	36.7	66.7	47.9	10.3
Digits Backward	DGB	0.0	0.0	6.7	6.7	3.3	16.7	10.0	43.3	30.0	83.3	48.7	11.0
Dots	DOT	0.0	0.0	0.0	0.0	13.3	13.3	20.0	20.0	46.7	86.7	51.4	9.7
Numbers & Letters Part A Speed	$N\&L_A$–spd	3.3	3.3	0.0	10.0	13.3	29.9	10.0	33.3	26.7	70.0	45.7	11.0
Numbers & Letters Part A Errors	$N\&L_A$–err	0.0	0.0	10.0	3.3	6.7	20.0	10.0	36.7	33.3	80.0	48.6	10.8
Numbers & Letters Part A Efficiency	$N\&L_A$–eff	3.3	3.3	0.0	6.7	16.7	30.0	10.0	43.3	16.7	70.0	45.0	10.6
Numbers & Letters Part B Efficiency	$N\&L_B$–eff	3.3	6.7	3.3	6.7	16.7	36.7	20.0	33.3	10.0	63.3	42.0	10.2
Numbers & Letters Part C Efficiency	$N\&L_C$–eff	0.0	0.0	3.3	6.7	10.0	20.0	30.0	33.3	16.7	80.0	45.2	8.9
Numbers & Letters Part D Efficiency	$N\&L_D$–eff	6.7	6.7	0.0	16.7	23.3	53.4	13.3	20.0	13.3	46.6	40.4	11.7
Numbers & Letters Part D Disruption	$N\&L_D$–dis	0.0	10.0	6.7	10.0	16.7	43.4	6.7	26.7	23.3	56.7	43.0	12.7
Driving Scenes	DRV	0.0	0.0	3.3	3.3	20.0	26.6	36.7	26.7	10.0	73.4	43.7	7.8

Note. $N = 30$.

Table 6.67
Percentage of Attention-Deficit/Hyperactivity Disorder (ADHD) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Language Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of ADHD group**						**% of ADHD group**				***M***	***SD***
Oral Production	OPD	0.0	0.0	6.7	6.7	23.3	36.7	26.7	16.7	20.0	63.4	44.0	9.7
Auditory Comprehension	AUD	10.0	0.0	0.0	0.0	6.7	16.7	3.3	40.0	40.0	83.3	48.4	11.3
Naming	NAM	0.0	0.0	0.0	3.3	3.3	6.6	0.0	26.7	66.7	93.4	54.7	6.1
Writing	WRT	3.3	0.0	0.0	3.3	3.3	9.9	10.0	53.3	26.7	90.0	49.7	8.3
Bill Payment	BIL	3.3	0.0	10.0	10.0	3.3	26.6	0.0	50.0	23.3	73.3	47.1	11.2

Note. $N = 30$.

Table 6.68
Percentage of Attention-Deficit/Hyperactivity Disorder (ADHD) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Memory Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of ADHD group**						**% of ADHD group**				***M***	***SD***
List Learning List A Immediate Recall	LLA–irc	0.0	0.0	3.3	10.0	20.0	33.3	20.0	36.7	10.0	66.7	44.1	8.6
List Learning List B Immediate Recall	LLB–irc	0.0.	3.3	0.0	3.3	6.7	13.3	16.7	53.3	16.7	86.7	47.0	8.5
List Learning List A Short Delayed Recall	LLA–sd:drc	0.0	0.0	0.0	10.0	10.0	20.0	23.3	16.7	40.0	80.0	48.7	10.8
List Learning List A Long Delayed Recall	LLA–ld:drc	3.3	0.0	0.0	3.3	10.0	16.6	26.7	23.3	33.3	83.3	48.0	11.1
Shape Learning Immediate Recognition	SHL–irg	0.0	0.0	6.7	0.0	6.7	13.4	23.3	30.0	33.3	86.6	48.2	8.7
Shape Learning Delayed Recognition	SHL–drg	0.0	6.7	0.0	6.7	6.7	20.1	3.3	40.0	36.7	80.0	48.5	11.0
Story Learning Phrase Unit Immediate Recall	STL–irc:phu	0.0	0.0	0.0	0.0	6.7	6.7	16.7	56.7	20.0	93.4	49.3	7.7
Story Learning Phrase Unit Delayed Recall	STL–drc:phu	0.0	0.0	0.0	3.3	3.3	6.6	23.3	50.0	20.0	93.3	48.9	8.5
Daily Living Memory Immediate Recall	DLM–irc	0.0	0.0	0.0	3.3	10.0	13.3	20.0	50.0	16.7	86.7	48.7	7.7
Daily Living Memory Delayed Recall	DLM–drc	0.0	0.0	3.3	10.0	10.0	23.3	6.7	36.7	33.3	76.7	47.0	9.1

Note. $N = 30$.

Table 6.69
Percentage of Attention-Deficit/Hyperactivity Disorder (ADHD) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Spatial Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of ADHD group**						**% of ADHD group**				***M***	***SD***
Visual Discrimination	VIS	0.0	6.7	0.0	6.7	3.3	16.7	16.7	20.0	46.7	83.4	49.1	11.1
Design Construction	DES	0.0	0.0	6.7	6.7	6.7	20.1	10.0	26.7	43.3	80.0	50.7	12.4
Figure Drawing Copy	FGD−cpy	0.0	0.0	0.0	13.3	13.3	26.6	13.3	30.0	30.0	73.3	48.2	11.0
Figure Drawing Copy Organization	FGD−cpy:org	0.0	0.0	0.0	3.4	10.3	13.7	17.2	37.9	31.0	86.1	49.3	9.3
Figure Drawing Immediate Recall	FGD−irc	0.0	3.3	6.7	6.7	6.7	23.4	13.3	46.7	16.7	76.7	46.5	10.8
Map Reading	MAP	0.0	0.0	3.3	3.3	10.0	16.6	6.7	46.7	30.0	83.4	49.5	9.8

Note. $N = 30$.

Table 6.70
Percentage of Attention-Deficit/Hyperactivity Disorder (ADHD) Sample Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Executive Functions Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of ADHD group**						**% of ADHD group**				***M***	***SD***
Mazes	MAZ	0.0	3.4	6.9	6.9	10.3	27.5	3.4	37.9	31.0	72.3	47.7	12.8
Judgment	JDG	0.0	0.0	6.9	13.8	17.2	37.9	31.0	27.6	3.4	62.0	41.2	8.5
Categories	CAT	0.0	0.0	0.0	3.4	3.4	6.8	37.9	27.6	27.6	93.1	49.0	9.9
Word Generation	WGN	3.4	0.0	0.0	17.2	10.3	30.9	13.8	34.5	20.7	69.0	44.7	9.9

Note. $N = 30$.

in part because of the severity of the patient's injury/disorder and impairments and, in part, because of the need for briefer evaluations. There is also a need for repeat evaluations in the rehabilitation setting to track recovery and/or the success of treatment. The NAB Screening Module meets two major assessment needs by (a) offering a relatively brief neuropsychological assessment of the major areas of functioning and (b) having two parallel forms. For this reason, a study was conducted to examine the validity and utility of the NAB Screening Module in an inpatient rehabilitation setting (Guilmette, 2003). In this type of setting, it is also common to have multidisciplinary assessments of a patient's functional status. This practice provides the unique opportunity for examining the relationship between the NAB Screening Module and both measures of functional independence and observations/assessments by other rehabilitation professionals (e.g., occupational therapists). As such, this study was also designed to obtain initial data to support the ecological validity of the NAB Screening Module (see Table 6.17).

The participants in this study (n = 39) represented consecutive admissions to an urban rehabilitation hospital. The participants ranged in age from 21 to 92 years (M = 65.5 years, SD = 16.0 years). The percentages of the sample by education level were 11% with ≤11 years of education, 28% with 12 years, 28% with 13 to 15 years, and 33% with ≥16 years. The average level of education was 12.5 years (SD = 2.2 years). The study consisted of 51% females and 49% males, with the following race/ethnicity distribution: 92% Caucasian, 5% African American, and 3% Other race/ethnicity.

The patients were referred for a brief neuropsychological evaluation, which included the 3MS (Teng & Chui, 1987), the Mental Control subtest of the WMS-III (Wechsler, 1997b), and the NAB Screening Module. Participants were excluded from the study if they were unable to use one or both upper extremities, had inadequate visual and auditory acuity, and/or did not speak English as their primary language. The participants in this study represented a variety of diagnoses (e.g., TBI, stroke). All participants were administered the NAB Screening Module by an experienced rehabilitation neuropsychologist. At the same time, all participants also were administered the Functional Independence Measure (FIM; Granger et al., 1986) by an experienced occupational therapist. As shown in Table 6.71, the mean 3MS raw score was 84.1 (SD = 6.3), and the mean Mental Control scaled score was 6.7 (SD = 2.5). FIM items are rated on a 7-point scale ranging from 1 = *patient performs <25% of tasks* to 7 = *complete independence*; higher scores reflect more competent performance. The mean FIM Social Interaction, Memory, and Problem Solving item scores were 5.8, 5.0, and 5.0, respectively. The FIM total raw score mean was 82.0 (SD = 14.8; range = 18 to 126) for the rehabilitation group.

Table 6.71
Mean Scores and Standard Deviations of the 3MS, WMS-III Mental Control, and FIM for the Inpatient Rehabilitation Group

Score	*M*	*SD*
3MS	84.1	6.3
WMS-III		
Mental Control Scaled score	6.7	2.5
FIM at midtreatment		
Social Interaction Item	5.8	1.0
Memory Item	5.0	1.2
Problem Solving Item	5.0	1.2
Total Raw score	82.0	14.8

Note. N = 39. 3MS = Modified Mini-Mental Status Examination (Teng & Chui, 1987); WMS-III = Wechsler Memory Scale–Third Edition (Wechsler, 1997b); FIM = Functional Independence Measures (Granger, Hamilton, & Sherwin, 1986).

As shown in Table 6.72, 91.7% of the rehabilitation group scored in the impaired range on the Screening Attention Domain score. Relatively high percentages of impairment were also observed on the Screening Language Domain (35.9%), Screening Memory Domain (30.7%), Screening Spatial Domain (55.4%), and Screening Executive Functions Domain (73.6%) scores. The Total Screening Index score showed a high percentage of impairment of 85.3%. The Screening Module primary score means (see Table 6.73) ranged from 29.0 for Screening Numbers & Letters Part A Efficiency (S-N&L_A–eff) to 46.8 for Screening Story Learning Immediate Recall (S-STL–irc). Similarly, the percentage of impaired scores ranged from 20.5% for Screening Shape Learning Delayed Recognition (S-SHL–drg) to 94.8% for Screening Numbers & Letters Part A Efficiency (S-N&L_A–eff).

Effect of Simulated Malingering on NAB Performance

A simulated malingering study was conducted as part of the NAB validation plan to examine the effect of feigned or exaggerated impairment on NAB performance (Ropacki, 2003; Turner et al., 2003). The simulated malingerers group (n = 50) consisted of healthy volunteers who had no history of neurologic disorder, psychiatric disorder, substance abuse, learning disability, or attention problems. The average age of the simulators group was 31.5 years (SD = 13.2 years; range = 19 to 65 years). The average education level of the simulators group was 14.8 years (SD = 1.7 years; range = 10 to 18 years). The study consisted of 56% females and 44% males.

Table 6.72
Percentage of Rehabilitation Inpatients Scoring Within Suggested Clinically Relevant Standard Score Ranges for the Screening Domain and Index Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
Standard score range		0-54	55-61	62-69	70-76	77-84	0-84	85-91	92-106	≥107	≥85		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Domain/Index score	**Acronym**	**% of inpatient group**						**% of inpatient group**				***M***	***SD***
Screening Attention Domain	S-ATT	5.6	19.4	27.8	22.2	16.7	91.7	5.6	2.8	0.0	8.4	69.4	11.2
Screening Language Domain	S-LAN	0.0	0.0	12.8	2.6	20.5	35.9	23.1	20.5	20.5	64.1	91.2	16.7
Screening Memory Domain	S-MEM	2.6	0.0	5.1	5.1	17.9	30.7	28.2	28.2	12.8	69.2	89.5	15.2
Screening Spatial Domain	S-SPT	0.0	13.2	5.3	13.2	23.7	55.4	18.4	18.4	7.9	44.7	82.8	15.3
Screening Executive Functions Domain	S-EXE	5.3	10.5	10.5	28.9	18.4	73.6	13.2	10.5	2.6	26.3	76.3	13.7
Total Screening Index	S-NAB	0.0	17.6	14.7	32.4	20.6	85.3	5.9	2.9	5.9	14.7	74.7	14.1

Note. $N = 39$.

Table 6.73
Percentage of Rehabilitation Inpatients Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Screening Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of inpatient group**						**% of inpatient group**				***M***	***SD***
Screening Digits Forward	S-DGF	0.0	2.6	2.6	10.3	15.4	30.9	23.1	38.5	7.7	69.3	43.7	8.5
Screening Digits Backward	S-DGB	0.0	0.0	12.8	10.3	25.6	48.7	25.6	17.9	7.7	51.2	39.7	8.1
Screening Numbers & Letters Part A Speed	S-N&L_A–spd	5.1	20.5	25.6	15.4	17.9	84.5	7.7	7.7	0.0	15.4	30.9	8.1
Screening Numbers & Letters Part A Errors	S-N&L_A–err	15.4	7.7	10.3	2.6	5.1	41.1	0.0	41.0	17.9	58.9	41.1	15.1
Screening Numbers & Letters Part A Efficiency	S-N&L_A–eff	20.5	12.8	23.1	20.5	17.9	94.8	0.0	5.1	0.0	5.1	29.0	7.7
Screening Numbers & Letters Part B Efficiency	S-N&L_B–eff	5.6	8.3	19.4	30.6	13.9	77.8	22.2	0.0	0.0	22.2	32.2	7.4
Screening Auditory Comprehension	S-AUD	15.4	0.0	2.6	2.6	5.1	25.7	5.1	35.9	33.3	74.3	45.8	13.6
Screening Naming	S-NAM	7.7	5.1	5.1	7.7	7.7	33.3	10.3	23.1	33.3	66.7	43.9	13.4
Screening Shape Learning Immediate Recognition	S-SHL–irg	0.0	0.0	12.8	5.1	5.1	23.0	15.4	41.0	20.5	76.9	46.6	11.6
Screening Shape Learning Delayed Recognition	S-SHL–drg	0.0	0.0	5.1	7.7	7.7	20.5	23.1	33.3	23.1	79.5	46.3	9.9
Screening Story Learning Immediate Recall	S-STL–irc	0.0	0.0	5.1	12.8	7.7	25.6	5.1	48.7	20.5	74.3	46.8	10.2
Screening Story Learning Delayed Recall	S-STL–drc	2.6	7.7	10.3	7.7	15.4	43.7	17.9	28.2	10.3	56.4	40.8	11.2
Screening Visual Discrimination	S-VIS	5.1	7.7	5.1	5.1	12.8	35.8	10.3	28.2	25.6	64.1	43.8	13.6
Screening Design Construction	S-DES	0.0	2.6	13.2	23.7	23.7	63.2	15.8	18.4	2.6	36.8	37.4	8.3
Screening Mazes	S-MAZ	13.2	10.5	13.2	23.7	21.1	81.7	10.5	7.9	0.0	18.4	31.7	8.6
Screening Word Generation	S-WGN	0.0	2.6	12.8	7.7	10.3	33.4	25.6	28.2	12.8	66.6	41.6	9.9

Note. $N = 39$.

The race/ethnicity of this group was 68% Caucasian, 12% African American, 4% Hispanic, and 16% Other race/ethnicity.

Participants in the simulators group were given instructions (see Figure 6.9) to simulate a situation in which they were involved in an automobile accident, received a head injury without an initial loss of consciousness that was followed by a brief visit to the emergency room and, although their initial symptoms had abated, were now required to undergo a neuropsychological evaluation because of their involvement in litigation for a large insurance/disability settlement. The accident scenario was created from information available in the public domain. Specifically, "traumatic brain injury symptoms" and similar phrases were entered into a variety of Internet search engines, and the resulting web sites were reviewed. This approach increases the ecological validity of this study because this methodology is likely similar to one that would be used by a naïve lay person who was seeking information on the effect of traumatic brain injury on cognitive functioning. Participants were further instructed to support their claim by demonstrating cognitive difficulties on the neuropsychological tests similar to those they "experienced" immediately following the accident but without making their malingering obvious to the examiner.

The study further mimicked real-life medicolegal situations (i.e., where the amount of financial settlement in head injury cases is directly related to the patient's ability to demonstrate believable deficits) because participants were instructed that the amount of money they would receive for participation in this study was directly related to their ability to feign believable cognitive deficits without detection. All simulated malingerers later received full payment and were thoroughly debriefed. Pre- and post-experimental questionnaires were used to ensure that participants understood and complied with the simulated malingering response set.

A normal control group (n = 50) was extracted from the NAB standardization sample and closely matched to the simulators group on the basis of age and education level. The average age of the control group was 31.4 years (*SD* = 13.1 years; range = 18 to 65 years). The average education level of the control group was 14.7 years (*SD* = 1.7 years; range = 10 to 18 years). There were 56% females and 44% males. The race/ethnicity of the control group was 62% Caucasian, 14% African American, 12% Hispanic, and 12% other race/ethnicity.

All participants were administered Form 1 of the NAB. The simulators group also received the Test of Memory Malingering (TOMM; Tombaugh, 1996), the Word Memory Test (WMT; Green et al., 1995), and the Victoria Symptom Validity Test (VSVT; Slick et al., 1997). Tables 6.74 through 6.80 present the percentage of simulators who fell

Figure 6.9
Accident Scenario for Simulators

Imagine that, within the last year, you were involved in a motor vehicle accident in which another driver hit your car. Although you did not suffer any serious physical injuries, you hit your head and suffered some minor cuts and bruises, as well as sore muscles. You never lost consciousness during or after this accident, and you have full memory for this event. Nevertheless, you were transported to the emergency room, examined, and released with some instructions about the typical things you ***may*** experience after a head injury including: frequent headaches, ringing in your ears, double vision, dizziness, nauseousness, increased fatigue, decreased motivation, and problems in thinking (like attentional problems, slowed thinking, problem-solving difficulties, and/or memory problems), as well as increased irritability, mood swings, anxiety, and/or depression. These hospital instructions also indicated that ***not*** everyone experiences ***all*** of these difficulties, and that these symptoms ***typically*** remit within 3- to 6-months.

Following your accident, you did experience some of these noted symptoms and subsequently missed some work. You also had to take time off from work for doctor's visits and follow-up exams. In addition to consulting with several doctors on your condition, you have retained an attorney who is assisting with your case to ensure you receive appropriate compensation for the damages to your vehicle plus the pain, suffering, and inconvenience this accident has caused. For the most part, your symptoms have improved, but you have now been told that you will have to undergo a neuropsychological evaluation as part of your lawsuit. The results of this evaluation will play a ***large part*** in the amount of settlement that you will receive. Although you do not want to be dishonest, you want your testing to reflect the severity of the problems you have experienced. Moreover, your ability to convey this information without making your exaggeration obvious has direct bearing on the amount of your financial settlement. Therefore, you want to perform on these tests the way you think you would have immediately following the accident in order to convince the court that you deserve a large financial settlement. However, if you are too obvious or you make your exaggeration obvious you risk being caught and receiving no financial award.

Table 6.74
Percentage of Simulated Malingerers Scoring Within Suggested Clinically Relevant Standard Score Ranges for the Screening Domain and NAB Index Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
Standard score range		0-54	55-61	62-69	70-76	77-84	0-84	85-91	92-106	≥107	≥85		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Domain/Index score	**Acronym**	**% of simulator group**						**% of simulator group**				***M***	***SD***
Screening Attention Domain	S-ATT	21.6	27.5	11.8	7.8	9.8	78.5	5.9	13.7	2.0	21.6	68.5	17.9
Screening Language Domain	S-LAN	13.7	0.0	3.9	2.0	21.6	41.2	3.9	11.8	43.1	58.8	99.9	32.8
Screening Memory Domain	S-MEM	3.9	7.8	11.8	11.8	29.4	64.7	13.7	15.7	5.9	35.3	80.4	14.6
Screening Spatial Domain	S-SPT	6.0	4.0	4.0	20.0	24.0	58.0	12.0	16.0	14.0	42.0	84.0	17.0
Screening Executive Functions Domain	S-EXE	0.0	13.7	13.7	27.5	15.7	70.6	3.9	23.5	2.0	29.4	78.1	14.9
Total Screening Index	S-NAB	10.0	6.0	26.0	8.0	24.0	74.0	12.0	8.0	6.0	26.0	75.3	15.6
Attention Index	ATT	36.0	16.0	12.0	12.0	8.0	84.0	6.0	8.0	2.0	16.0	66.1	16.8
Language Index	LAN	13.7	0.0	19.6	19.6	13.7	66.6	9.8	21.6	2.0	33.4	76.7	16.6
Memory Index	MEM	11.8	17.6	13.7	17.6	15.7	76.4	15.7	7.8	0.0	23.5	72.0	13.7
Spatial Index	SPT	9.8	5.9	15.7	21.6	17.6	70.6	13.7	5.9	9.8	29.4	77.4	16.8
Executive Functions Index	EXE	10.0	2.0	22.0	24.0	18.0	76.0	16.0	6.0	2.0	24.0	74.5	13.3
Total NAB Index	T-NAB	20.4	8.2	22.4	22.4	16.3	89.7	4.1	4.1	2.0	10.2	69.1	13.9

Note. $N = 50$.

Table 6.75
Percentage of Simulated Malingerers Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Screening Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of simulator group**						**% of simulator group**				***M***	***SD***
Screening Digits Forward	S-DGF	21.6	11.8	9.8	11.8	19.6	74.6	7.8	11.8	5.9	25.5	33.5	13.2
Screening Digits Backward	S-DGB	0.0	9.8	15.7	15.7	13.7	54.9	21.6	15.7	7.8	45.1	37.7	10.6
Screening Numbers & Letters Part A Speed	S-N&L$_A$–spd	33.3	5.9	11.8	11.8	5.9	68.7	13.7	7.8	9.8	31.3	33.3	15.2
Screening Numbers & Letters Part A Errors	S-N&L$_A$–err	31.4	3.9	0.0	3.9	5.9	45.1	3.9	51.0	0.0	54.9	36.5	13.7
Screening Numbers & Letters Part A Efficiency	S-N&L$_A$–eff	37.3	5.9	11.8	9.8	9.8	74.6	9.8	5.9	9.8	25.5	31.3	14.0
Screening Numbers & Letters Part B Efficiency	S-N&L$_B$–eff	9.8	7.8	11.8	19.6	11.8	60.8	11.8	13.7	13.7	39.2	37.9	14.3
Screening Auditory Comprehension	S-AUD	37.3	0.0	0.0	0.0	0.0	37.3	3.9	25.5	33.3	62.7	45.2	22.7
Screening Naming	S-NAM	17.6	2.0	0.0	2.0	2.0	23.6	0.0	9.8	66.7	76.5	50.9	17.3
Screening Shape Learning Immediate Recognition	S-SHL–irg	0.0	5.9	2.0	7.8	11.8	27.5	35.3	21.6	15.7	72.6	43.5	9.5
Screening Shape Learning Delayed Recognition	S-SHL–drg	0.0	5.9	2.0	9.8	17.6	35.3	25.5	19.6	19.6	64.7	43.5	10.5
Screening Story Learning Immediate Recall	S-STL–irc	2.0	3.9	11.8	11.8	29.4	58.9	7.8	25.5	7.8	41.1	39.1	9.7
Screening Story Learning Delayed Recall	S-STL–drc	3.9	3.9	9.8	19.6	25.5	62.7	19.6	13.7	3.9	37.2	37.0	8.6
Screening Visual Discrimination	S-VIS	15.7	13.7	19.6	5.9	2.0	56.9	11.8	3.9	27.5	43.2	36.6	15.3
Screening Design Construction	S-DES	0.0	0.0	8.0	4.0	12.0	24.0	28.0	34.0	14.0	76.0	44.8	9.3
Screening Mazes	S-MAZ	19.6	5.9	7.8	13.7	21.6	68.6	9.8	17.6	3.9	31.3	34.5	11.2
Screening Word Generation	S-WGN	0.0	2.0	9.8	15.7	19.6	47.1	21.6	19.6	11.8	53.0	41.5	10.8

Note. $N = 50$.

Table 6.76
Percentage of Simulated Malingerers Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Attention Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of simulator group**						**% of simulator group**				***M***	***SD***
Digits Forward	DGF	21.6	11.8	9.8	11.8	19.6	74.6	7.8	11.8	5.9	25.5	33.5	13.2
Digits Backward	DGB	0.0	9.8	15.7	15.7	13.7	54.9	21.6	15.7	7.8	45.1	37.7	10.6
Dots	DOT	17.6	9.8	2.0	11.8	17.6	58.8	19.6	13.7	7.8	41.1	35.3	11.8
Numbers & Letters Part A Speed	$N\&L_A$–spd	17.6	0.0	11.8	7.8	19.6	56.8	7.8	19.6	15.7	43.1	39.2	15.1
Numbers & Letters Part A Errors	$N\&L_A$–err	23.5	7.8	9.8	13.7	13.7	68.5	7.8	13.7	9.8	31.3	34.2	13.0
Numbers & Letters Part A Efficiency	$N\&L_A$–eff	19.6	0.0	13.7	15.7	19.6	68.6	9.8	13.7	7.8	31.3	36.0	14.2
Numbers & Letters Part B Efficiency	$N\&L_B$–eff	17.6	9.8	15.7	13.7	13.7	70.5	11.8	15.7	2.0	29.5	33.5	12.4
Numbers & Letters Part C Efficiency	$N\&L_C$–eff	0.0	7.8	27.5	17.6	11.8	64.7	15.7	15.7	3.9	35.3	35.7	9.6
Numbers & Letters Part D Efficiency	$N\&L_D$–eff	7.8	7.8	7.8	11.8	13.7	48.9	13.7	27.5	9.8	51.0	39.5	12.5
Numbers & Letters Part D Disruption	$N\&L_D$–dis	2.0	0.0	3.9	0.0	15.7	21.6	9.8	21.6	47.1	78.5	52.2	14.1
Driving Scenes	DRV	25.5	2.0	21.6	27.5	7.8	84.4	7.8	7.8	0.0	15.6	29.9	8.7

Note. $N = 50$.

Table 6.77
Percentage of Simulated Malingerers Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Language Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of simulator group**						**% of simulator group**				***M***	***SD***
Oral Production	OPD	0.0	2.0	13.7	5.9	17.6	39.2	25.5	23.5	11.8	60.8	41.8	9.9
Auditory Comprehension	AUD	51.0	3.9	0.0	7.8	3.9	66.6	2.0	19.6	11.8	33.4	32.0	15.4
Naming	NAM	25.5	3.9	7.8	3.9	5.9	47.0	5.9	15.7	31.4	53.0	40.1	16.3
Writing	WRT	13.7	2.0	5.9	0.0	9.8	31.4	2.0	49.0	17.6	68.6	43.2	12.8
Bill Payment	BIL	43.1	0.0	0.0	3.9	2.0	49.0	2.0	45.1	3.9	51.0	36.3	15.8

Note. $N = 50$.

Table 6.78
Percentage of Simulated Malingerers Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Memory Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of simulator group**						**% of simulator group**				***M***	***SD***
List Learning List A Immediate Recall	LLA–irc	0.0	11.8	9.8	31.4	9.8	62.8	21.6	15.7	0.0	37.3	36.1	8.9
List Learning List B Immediate Recall	LLB–irc	0.0	7.8	5.9	13.7	23.5	50.9	19.6	25.5	3.9	49.0	39.6	9.3
List Learning List A Short Delayed Recall	LLA–sd:drc	9.8	15.7	11.8	9.8	7.8	54.9	15.7	19.6	9.8	45.1	36.4	13.4
List Learning List A Long Delayed Recall	LLA–ld:drc	15.7	13.7	13.7	13.7	9.8	66.6	15.7	13.7	3.9	33.3	33.1	11.6
Shape Learning Immediate Recognition	SHL–irg	19.6	3.9	13.7	9.8	7.8	54.8	11.8	29.4	3.9	45.1	35.9	12.4
Shape Learning Delayed Recognition	SHL–drg	27.5	9.8	9.8	5.9	13.7	66.7	7.8	15.7	9.8	33.3	33.5	13.0
Story Learning Phrase Unit Immediate Recall	STL–irc:phu	0.0	5.9	11.8	11.8	21.6	51.1	23.5	25.5	0.0	49.0	38.5	9.0
Story Learning Phrase Unit Delayed Recall	STL–drc:phu	0.0	2.0	23.5	15.7	19.6	60.8	15.7	17.6	5.9	39.2	37.5	9.4
Daily Living Memory Immediate Recall	DLM–irc	2.0	7.8	17.6	7.8	27.5	62.7	11.8	11.8	13.7	37.3	39.2	12.3
Daily Living Memory Delayed Recall	DLM–drc	47.1	7.8	3.9	7.8	9.8	76.4	2.0	17.6	3.9	23.5	29.6	13.2

Note. $N = 50$.

Table 6.79
Percentage of Simulated Malingerers Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Spatial Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of simulator group**						**% of simulator group**				***M***	***SD***
Visual Discrimination	VIS	39.2	7.8	9.8	9.8	5.9	72.5	5.9	3.9	17.6	27.4	31.6	15.1
Design Construction	DES	0.0	3.9	2.0	11.8	5.9	23.6	17.6	31.4	27.5	76.5	46.7	11.7
Figure Drawing Copy	FGD–cpy	2.0	9.8	23.5	23.5	13.7	72.5	5.9	9.8	11.8	27.5	35.9	11.2
Figure Drawing Copy Organization	FGD–cpy:org	0.0	0.0	2.0	7.8	11.8	21.6	21.6	47.1	9.8	78.5	46.4	8.9
Figure Drawing Immediate Recall	FGD–irc	0.0	7.8	3.9	25.5	27.5	64.7	9.8	19.6	5.9	35.3	38.4	9.2
Map Reading	MAP	7.8	2.0	5.9	11.8	25.5	53.0	15.7	17.6	13.7	47.0	40.3	11.4

Note. $N = 50$.

Table 6.80
Percentage of Simulated Malingerers Scoring Within Suggested Clinically Relevant *T*-Score Ranges for the Executive Functions Module Primary Scores

		Range of performance											
		Impaired range						Nonimpaired range					
		Severe	Moderate-to-severe	Moderate	Mild-to-moderate	Mild	Total impaired	Below average	Average	Above average	Total non-impaired		
***T*-score range**		0-19	20-24	25-29	30-34	35-39	0-39	40-44	45-54	≥55	≥40		
% predicted from normal distribution		0.1	0.4	1.5	4.0	8.6	14.6	14.4	38.2	32.8	85.4		
Test	**Acronym**	**% of simulator group**						**% of simulator group**				***M***	***SD***
Mazes	MAZ	2.0	0.0	7.8	11.8	7.8	29.4	21.6	31.4	17.6	70.6	44.0	10.3
Judgment	JDG	15.7	15.7	23.5	15.7	17.6	88.2	5.9	5.9	0.0	11.8	29.3	8.2
Categories	CAT	8.0	4.0	14.0	14.0	24.0	64.0	16.0	10.0	10.0	36.0	37.2	11.1
Word Generation	WGN	0.0	6.0	6.0	16.0	8.0	36.0	36.0	22.0	6.0	64.0	40.8	10.0

Note. $N = 50$.

into clinically relevant standardized score ranges on various NAB scores by module, as well as means and standard deviations of the NAB scores.

For each NAB module, the primary scores and the module index were entered as dependent variables into a multivariate analysis of variance (MANOVA), with group as the dependent variable. The MANOVA results indicated a statistically significant effect of group on each NAB module. Univariate analysis of variance (ANOVA) procedures were used to test the effect of group on individual NAB scores. The results indicated statistically significant group differences on most NAB primary scores and module indexes, with the simulators group scores significantly worse than those of the normal control group. Means, standard deviations, and ANOVA results for selected NAB scores for both groups are presented in Table 6.81.

For each NAB module, the primary scores and module index were entered into a stepwise logistic regression analysis with group as the dependent variable. Across the five NAB modules, eight primary scores and three module index scores were identified as highly predictive of group membership: Driving Scenes (DRV), Auditory Comprehension (AUD), Visual Discrimination (VIS), Figure Drawing Immediate Recall (FGD–irc), Daily Living Memory Immediate Recall (DLM–irc), Daily Living Memory Delayed Recall (DLM–drc), Judgment (JDG), Categories (CAT), Attention Index (ATT), Language Index (LAN), and Memory Index (MEM). These 11 scores were then entered into a separate logistic regression analysis with group as the dependent variable. The results indicated that these scores accurately predict membership in the simulators and normal control groups (see Table 6.82).

Finally, the ability of these selected NAB scores to discriminate simulators from traumatic brain injury patients was assessed with logistic regression. The TBI sample (n = 31) characterized previously in this chapter was used. Selected NAB scores were used as predictor variables, and the results indicated that this group of variables accurately predicts membership in the simulators and traumatic brain injury patient groups (see Table 6.83). ANOVA procedures were used to test the effect of group on individual NAB scores. The results indicated statistically significant group differences on 10 of these 11 NAB scores, with the simulators group scores significantly worse than those of the traumatic brain injury group. Means, standard deviations, and ANOVA results for the selected NAB variables are presented in Table 6.84.

The relationship between these selected NAB scores and simulated malingering was further explored in a correlations study. Correlations between these scores and scores on the TOMM, WMT, and VSVT were calculated (see Table 6.85). Low to moderate correlations were observed between these 11 NAB scores and measures derived from these three criterion measures of malingering/effort. In summary, the results from the simulated malingering study identified 11 NAB scores that seem to be sensitive to malingering/diminished effort. Additional research is needed to more fully elucidate the effect of malingering/diminished effort on NAB performance.

SUMMARY OF VALIDITY EVIDENCE

As stated earlier in this chapter, establishment of the validity for a test or test battery is an ongoing, dynamic process that begins with the initial design and selection of test content and continues throughout the development process and beyond. The data presented in this chapter provide evidence for the several different aspects of test validity: content validity, construct and internal validity, and criterion-related validity. Evidence for the clinical utility and sensitivity of the NAB has also been presented, as has initial evidence for the ecological validity of the NAB Screening Module. In addition, the results of the simulated malingering study provide initial information potentially useful in the interpretation of NAB scores in forensic situations. The data presented in this chapter provide strong evidence for the overall validity of the NAB. However, as with all tests, these data should be considered the beginning of the ongoing process of validation.

Table 6.81
Means and Standard Deviations of Selected NAB Scores for the Simulated Malingerers and Normal Control Groups

Test	Acronym	Simulators[a]		Normal controls[b]		ANOVA		
		M	*SD*	*M*	*SD*	*F*	*p*	η
Primary score								
Driving Scenes	DRV	29.62	8.50	49.82	10.33	113.92	0.000	.73
Auditory Comprehension	AUD	31.64	15.31	48.52	5.48	53.83	0.000	.60
Daily Living Memory Immediate Recall	DLM–irc	39.38	12.30	48.26	9.31	16.57	0.000	.38
Daily Living Memory Delayed Recall	DLM–drc	29.56	13.38	48.98	8.65	74.30	0.000	.66
Visual Discrimination	VIS	31.38	15.16	50.42	10.32	53.87	0.000	.60
Figure Drawing Immediate Recall	FGD–irc	38.74	9.00	50.41	10.59	34.94	0.000	.52
Judgment	JDG	29.48	8.15	48.40	10.89	96.80	0.000	.71
Categories	CAT	36.76	10.82	49.84	7.65	48.42	0.000	.58
Index score								
Attention Index	ATT	66.16	16.92	98.74	13.19	114.42	0.000	.74
Language Index	LAN	76.16	16.30	96.90	11.45	54.20	0.000	.60
Memory Index	MEM	72.14	13.78	100.66	12.75	115.38	0.000	.73

[a]*N* = 50. [b]*N* = 50.

Table 6.82
Logistic Regression Group Classification of Simulated Malingerers and Normal Control Participants

Actual group membership	Predicted group membership (*n*)		% correct
	Normal controls[a]	Simulators[b]	
Simulators	2	46	95.8
Normal controls	46	3	93.9
Overall % correct			94.8

[a]*N* = 50. [b]*N* = 50.

Table 6.83
Logistic Regression Group Classification of Simulated Malingerers and Traumatic Brain Injury Patients

Actual group membership	Predicted group membership (n): Simulators[a]	TBI patients[b]	% correct
Simulators	44	4	91.7
Traumatic brain injury (TBI) patients	4	25	86.2
Overall % correct			89.6

[a]N = 50. [b]N = 31.

Table 6.84
Means and Standard Deviations of Selected NAB Scores for the Simulated Malingerers and Traumatic Brain Injury Groups

		Simulators[a]		TBI patients[b]		ANOVA		
Test	**Acronym**	M	SD	M	SD	F	p	η
Primary score								
Driving Scenes	DRV	29.62	8.50	44.09	9.12	53.43	0.000	.63
Auditory Comprehension	AUD	31.64	15.31	51.59	6.04	44.91	0.000	.61
Daily Living Memory Immediate Recall	DLM–irc	39.38	12.30	51.84	11.67	20.84	0.000	.46
Daily Living Memory Delayed Recall	DLM–drc	29.56	13.38	45.94	13.16	29.61	0.000	.52
Visual Discrimination	VIS	31.38	15.16	52.09	8.74	49.12	0.000	.62
Figure Drawing Immediate Recall	FGD–irc	38.74	9.00	45.50	10.82	9.39	0.000	.32
Judgment	JDG	29.48	8.15	42.16	9.38	41.93	0.000	.59
Categories	CAT	36.76	10.82	40.09	7.89	2.26	0.137	.17
Index score								
Attention Index	ATT	66.16	16.92	89.31	18.55	33.57	0.000	.55
Language Index	LAN	76.16	16.30	96.10	9.28	36.41	0.000	.57
Memory Index	MEM	72.14	13.78	96.19	17.24	48.76	0.000	.62

[a]N = 50. [b]N = 31.

Table 6.85
Correlations Between Selected NAB Scores and Measures of Malingering for the Simulated Malingerers Group

		TOMM score			WMT score				VSVT score		
NAB score	Acronym	Trial 1	Trial 2	Retention	Immediate Recall	Delayed Recall	Consistency Score 1	Consistency Score 2	Easy Items	Hard Items	Total Score
Primary score											
Driving Scenes	DRV	.43	.56	.62	.48	.65	.52	.27	.36	.49	.52
Auditory Comprehension	AUD	.26	.34	.34	.24	.45	.21	.36	.34	.36	.41
Daily Living Memory Immediate Recall	DLM–irc	.33	.39	.38	.28	.41	.31	.22	.12	.39	.35
Daily Living Memory Delayed Recall	DLM–drc	.47	.56	.57	.25	.55	.44	.43	.32	.52	.53
Visual Discrimination	VIS	.33	.39	.38	.33	.48	.38	.34	.38	.57	.59
Figure Drawing Immediate Recall	FGD–irc	.03	.14	.19	.12	.18	.11	–.03	.04	.01	.02
Judgment	JDG	.25	.35	.28	.25	.39	.19	.23	.28	.19	.26
Categories	CAT	–.02	.06	.17	.18	.19	.15	–.05	.34	.13	.23
Index score											
Attention Index	ATT	.38	.54	.60	.33	.59	.44	.34	.41	.61	.63
Language Index	LAN	.36	.50	.53	.45	.65	.39	.38	.50	.52	.60
Memory Index	MEM	.52	.65	.67	.39	.68	.55	.33	.35	.54	.55

Note. N = 50. TOMM = Test of Memory Malingering (Tombaugh, 1996); WMT = Word Memory Test (Green, Allen, & Astner, 1995); VSVT = Victoria Symptom Validity Test (Slick, Hopp, Strauss, & Thompson, 1997).