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Reliability and validity of the RBANS in a traumatic brain injured sample

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Abstract

The RBANS has become increasingly utilized in various populations since it reliably assesses individual neurocognitive domains in a rapid, efficient manner. The present study examined the convergent validity of the RBANS to frequently administered instruments in a moderate–severe traumatic brain injured (M–S TBI) sample. Fifty-seven individuals who sustained a M–S TBI were included in this study. The RBANS subtests showed moderate to strong internal reliability within the sample. Most of the subtests displayed moderate to strong correlations with the other neuropsychological tests, including the CVLT-II, COWAT, and WAIS-III subtests. The strongest correlations were within the RBANS Attention Index, with both the Digit Span and Coding subtests showing strong correlations with their WAIS-III counterparts. The RBANS measures distinct abilities that supplement other neuropsychological instruments that assess similar functions within a TBI sample. In addition to its administration advantages, the results of this study provide support for the use of the RBANS as a clinical valid and reliable tool in the brief screening of individuals with M–S TBI.

Keywords: Brain injury; RBANS

The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) was initially designed as a screening tool for the assessment of dementia (Randolph, 1998). Since its inception, however, it has gained popularity for use with other populations due to its many advantages, including its short administration time, co-normed index scores, inclusion of a summary score, and alternate forms. Recent research has supported the clinical application of the RBANS as a neuropsychological screening tool within various populations, including multiple sclerosis (Beatty, 2004) and cerebrovascular disorders (Larson et al., 2003; Larson, Kirschner, Bode, Heinemann, & Goodman, 2005). It has also been reliable in its ability to differentiate Alzheimer's dementia from vascular dementia (Randolph, 1997), Parkinson's disease (Beatty et al., 2003), and Huntington's disease (Randolph, Tierney, Mohr, & Chase, 1998).

Recently, researchers have expanded their evaluation of the RBANS' clinical utility by examining its psychometric properties within various populations. Most of this research has focused on the construct validity of the RBANS. In its initial standardization, Randolph (1998) examined the construct validity of the RBANS within a mixed clinical sample, comprising mostly dementia cases, and found the RBANS Index scores to demonstrate strong convergent validity with

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other neuropsychological measures. For example, the Visuospatial/Constructional Index score was highly correlated with both the Judgment of Line Orientation (JOLO; Benton, Hamsher, Varney, & Spreen, 1983) and the Rey Complex Figure Test (RCFT; Meyers & Meyers, 1995), whereas the Language Index was strongly associated with the Boston Naming Test (BNT; Kaplan, Goodglass, & Weintraub, 1983) and the Controlled Oral Word Association Test (COWAT; Benton, Hamsher, & Sivan, 1978). Additionally, the RBANS Total Scale score was strongly correlated with the Full Scale IQ from the WAIS-R (The Psychological Corporation, 1981).

Since Randolph's initial study, the validation of the RBANS and its individual subtests have been examined by numerous researchers (Duff et al., 2003, 2005; Gontkovsky, McSwan, & Scott, 2002) and these studies have pointed out that the ability to interpret the subtests enhances the clinical utility of the RBANS. Specifically, Duff et al. (2003) extended the original normative data of the RBANS by reporting on RBANS performances in a group of 718 older adults. They opined that one of the strengths of the RBANS relates to clinicians' ability to interpret individual subtests and make direct comparisons between subtests. Additionally, a separate research endeavour investigating the determination of cognitive change across time in 223 older adults noted that differences utilization of RBANS' subtests would be clinically useful (Duff et al., 2005).

Some of the aforementioned studies relied on mixed clinical samples that comprised individuals with Alzheimer's disease, vascular dementia, HIV dementia, Huntington's disease, Parkinson's disease, Major Depressive Disorder, schizophrenia, and closed head injury. It can be argued that the neuropsychological presentations of these populations differ and thus require separate evaluations as it pertains to the construct validity of the RBANS. Such research has recently been undertaken and the RBANS Index and subtest scores have demonstrated strong convergent validity in populations including schizophrenia (Gold, Queern, Iannone, & Buchanan, 1999) and stroke (Larson et al., 2005). In the study conducted by Larson and colleagues, all Index scores were shown to be strongly correlated with other neuropsychological measures, with the exception of the Attention Index. The authors suggested that the poor overall construct validity of the Attention Index was a result of the multifaceted nature of attention and that the tasks that comprise the RBANS Attention Index (Digit Span and Coding) tap other aspects of attention than those measured in their battery. The results of the study suggest that an evaluation of the individual RBANS subtests is needed.

Traumatic brain injury (TBI) can lead to a diverse range of neuropsychological deficits, including attention, memory, processing speed, and executive functioning (Axelrod, Fichtenberg, Liethen, Czarnota, & Stucky, 2001). Given the ease of administration, ability to assess a broad range of independent neuropsychological domains affected by TBI, the availability of alternate forms that allow for repeated evaluations, and sensitivity to milder impairments, the RBANS could be a useful tool in the assessment of TBI in both inpatient and outpatient settings. In Randolph's (1998) original examination of 31 individuals with mixed severity TBI, significant deficits were seen across all Index scores. The RBANS has also been found to be more sensitive to TBI-related deficits than other cognitive screening tools like the Mini Mental Status Examination (MMSE) and Neurocognitive Status Examination (COGNISTAT) (Carone, Burns, Gold, & Mittenberg, 2004). Moser and Schatz (2002) showed that in young athletes (aged 14–19 years), the RBANS detected effects of a recent concussion. Other studies have supported the RBANS' utility in discriminating between concussed and non-concussed individuals, but only in regards to immediate and delayed memory indices (Killam, Cautin, & Santucci, 2005). McKay and colleagues (McKay, Wertheimer, Fichtenberg, & Casey, submitted for publication) examined the clinical utility of the RBANS by comparing the RBANS Index scores of individuals with TBI and healthy controls. All Index scores were significantly lower in the TBI group than the control group and the RBANS Total score exhibited very strong sensitivity and specificity to TBI. The Attention Index showed the weakest sensitivity and specificity to TBI, and the authors suggested that future research should examine the psychometric properties of the individual subtests within TBI populations.

In sum, research examining the clinical utility and psychometric properties of the RBANS has shown promising results. However, these results have been limited by either a reliance on small mixed clinical samples or a primary focus on the Index scores while ignoring the individual subtests. Given the equivocal results pertaining to the construct validity of the Index scores, particularly the Attention Index, examination of the individual subtests is warranted. The purpose of the present study was to evaluate the internal reliability of the RBANS Index scores and construct validity of the RBANS subtest scores in a sample of persons who sustained a traumatic brain injury. For the purposes of homogeneity of the sample, this study was limited to moderate and severe injuries. First, it was hypothesized that the RBANS Indexes would exhibit strong internal reliability within the TBI sample, with the exception of the Language and Attention Index scores, which are composed of subtests that are typically the most and least sensitive to brain injury (Semantic Fluency and Coding; Digit Span and Picture Naming, respectively). Second, it was hypothesized the RBANS subtests would demonstrate convergent validity through its strong correlations with other commonly used neuropsychological measures across its various domains. Overall, these results would support the reliability and construct validity of the RBANS within a TBI sample.

1. Method

1.1. Participants

This retrospective study consisted of 57 consecutive brain injury cases referred to the neuropsychology service of an outpatient neurorehabilitation clinic associated with a major rehabilitation hospital located in the Midwest United States. All subjects were at least 20 years of age, raised and educated in North America, and spoke English as their primary language. Inclusion criteria required a medically documented history of brain injury, current need for cognitive neurorehabilitation or ongoing health care support to address chronic cognitive deficits, and conventional medical signs of brain injury (e.g., loss of consciousness, post-traumatic amnesia, and/or positive neuroimaging) documented in the medical record.

Subjects were excluded if they had a history of any other conditions associated with organic brain dysfunction, such as learning disability, attention deficit disorder, major substance abuse, or any neurological disorder. Those suspected of dissimulation or suboptimal effort were also excluded based on the following criteria: a Trial 1 score below 44 or Trial 2 score below 47 on the Test of Memory Malingering (TOMM; Tombaugh, 1996) or a score below 7 on Reliable Digits on the WAIS-III (Axelrod, Fichtenberg, Millis, & Wertheimer, 2006).

Demographic and injury characteristics of the TBI group are presented in Tables 1 and 2, respectively. Admission Glasgow Coma Scale scores (GCS) were indicative of moderate to severe degree of brain injury (GCS $\leq$ 12) in all cases. Where available, neuroimaging verified cortical damage in 51 cases and failed to do so in 1 case.

1.2. Materials and procedures

This study compared the internal reliability (i.e., alpha coefficients) for each of the RBANS' Index scores as well as the convergent validity of the RBANS subtests by comparing them to other various neuropsychological measures. The RBANS consists of six Index Scores: Total Scale Index and five domain-specific Index Scores. The latter include the Immediate Memory Index, Visuospatial/Constructional Index, Language Index, Attention Index, and Delayed Memory Index. With the exception of the Delayed Memory Index that is based on four subtests, each of the five Index Scores is based on two subtests. The Immediate Memory Index consists of List Learning and Story Memory subtests; the Attention Index consists of Digit Span and Coding subtests; the Visuospatial/Constructional Index consists of Figure Copy and Line Orientation subtests; the Language Index consists of Picture Naming and Semantic Fluency subtests; the Delayed Memory Index consists of List Recall, Story Recall, List Recognition, and Figure Recall subtests.

Table 1
Demographic characteristics of participants

Age	
Mean (S.D.)	35.72 (14.62)
Range	18–72
Education	
Mean (S.D.)	12.58 (1.61)
Range	10–18
Gender	
Males	35
Females	22
Race	
Caucasian	40
African American	17

Table 2
Injury characteristics of participants

Months post-injury	
Mean	84.88 (S.D. = 101.15)
Range	1–359
Cause of head trauma	
MVA	42 cases
Pedestrian-vs.-MVA	12 cases
Motorcycle	3 cases
ER admission GCS	
3–8	51 cases
9–12	6 cases
Length of unconsciousness (LOC)	
>28 days	15 cases
14–28 days	11 cases
7–13 days	7 cases
1–6 days	9 cases
1–24 h	10 cases
<1 h	5 cases
Length of post-traumatic amnesia (PTA)	
>4 weeks	33 cases
1–4 weeks	14 cases
1–7 days	8 cases
<24 h	2 cases
Neuroimaging	
Positive	50 cases
Negative	1 case
Missing	6 cases

Note: MVA, Motor vehicle accident; GCS, Glasgow Coma Scale.

For the evaluation of convergent validity, correlations between the raw scores for each of the individual RBANS subtests and comparable neuropsychological measures were examined. The Immediate Memory subtests (List Learning and Story Memory) were compared to the Trials 1–5 Total Recall score from the California Verbal Learning Test-Second Edition (CVLT-II; Delis, Kramer, Kaplan, & Ober, 2000). The Figure Copy and Line Orientation subtests were compared to the corrected raw score of the Benton Visual Retention Test-Fourth Edition (BVRT; Benton, 1974). The Picture Naming subtest of the RBANS was compared to the raw scores from the Multilingual Aphasia Examination Visual Naming subtest (MAE Visual Naming; Benton et al., 1978), whereas the Semantic Fluency subtest was compared to the Controlled Oral Word Association Test (COWAT; Benton et al., 1978). For the Attention subtest, the Digit Span and Coding subtests of the RBANS were compared to their counterparts from the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III Digit Span and Digit Symbol Coding; The Psychological Corporation, 1997). The List and Story Recall subtests from the RBANS were correlated with the Long Delay Free Recall raw scores from the CVLT-II and the List Recognition subtest was compared to its counterpart from the CVLT-II (i.e., hits raw score). Finally, the Figure Recall subtest was compared to the BVRT correct raw score.

2. Results

To test the internal consistency of the RBANS, Cronbach alphas were calculated for each of the five Index scores and the Total Scale score (see Table 3). Overall, the RBANS Total Scale score showed strong internal consistency (.8372) in the TBI sample. Also showing strong internal reliability were the Immediate Memory, Delayed Memory, and Visuospatial/Constructional Indexes. In contrast, as hypothesized, both the Language and Attention Index scores showed weak reliability between each of its comprising subtests.

To examine the second hypothesis pertaining to the convergent validity of the RBANS subtests, correlations between each of the RBANS subtests and comparable neuropsychological measures were analyzed. All measures were assessed

Table 3
Internal reliability (alpha coefficients) of Index Scores, Combined Memory Index, and Total Scale Index

Subtest scores	Cronbach's alpha
List Learning and Story Memory (Immediate Memory)	.7483
Figure Copy and Line Orientation (Visuospatial/Constructional)	.7582
Picture Naming and Semantic Fluency (Language)	.3292
Digit Span and Coding (Attention)	.1611
List Recall, List Recognition, Story Recall, and Figure Recall (Delayed Memory)	.7710
All subtests (Total Scale Index)	.8372

for violations of normality assumptions. Of these, the RBANS Figure Copy, Line Orientation, Picture Naming, and List Recognition subtests violated assumptions. Therefore, non-parametric correlational analyses (Spearman's rho) were utilized for these subtests. For all other analyses, Pearson correlation coefficients (r) were used. Means and standard deviations of all measures can be seen in Table 4.

As can be seen in Table 5, the RBANS subtests demonstrated strong correlations with their comparable neuropsychological tests, thus supporting the second hypothesis. Two of the strongest correlations were between the subtests comprising the RBANS Attention Index and their comparable WAIS-III counterparts, Digit Span (DS) and Digit Symbol Coding (DSC). Within the Immediate Memory Index, List Learning was strongly correlated with the CVLT-II Trials 1–5 Total score, whereas Story Memory also showed a moderate relationship with this measure. The Delayed Memory Index's subtests also showed strong correlations with comparable CVLT-II measures. RBANS List Recall

Table 4
Means and standard deviations of the RBANS and neuropsychological measures

Variable	Mean (S.D.)	*N*
RBANS Indexes		
Immediate Memory	77.12 (15.58)	57
Visuospatial/Construction	83.28 (16.58)	57
Language	79.21 (17.26)	57
Attention	72.91 (15.31)	57
Delayed Memory	72.16 (19.40)	57
Total Scale	70.89 (13.29)	57
RBANS subtests		
List Learning	22.67 (5.39)	57
Story Memory	14.26 (4.38)	57
Figure Copy	16.53 (3.78)	57
Line Orientation	14.75 (3.75)	57
Picture Naming	8.95 (1.37)	57
Semantic Fluency	14.58 (4.88)	57
Digit Span	9.35 (2.18)	57
Coding	33.16 (13.15)	57
List Recall	2.96 (2.51)	57
Story Recall	6.60 (3.34)	57
List Recognition	17.89 (2.65)	57
Figure Recall	9.68 (4.64)	57
CVLT-II Trials 1–5 Total	36.22 (11.39)	51
CVLT-II Long Delay Free Recall	5.43 (3.98)	51
CVLT-II Recognition Hits	13.43 (2.12)	51
BVRT correct	4.95 (2.16)	42
BVRT errors	8.45 (4.69)	42
MAE Visual Naming	50.22 (6.01)	18
COWAT	28.25 (8.96)	57
WAIS-III Digit Span	14.63 (3.51)	57
WAIS-III Digit Symbol Coding	48.00 (18.53)	56

Note: CVLT-II, California Verbal Learning Test-Second Edition; BVRT, Benton Visual Retention Test; MAE, Multilingual Aphasia Examination; WAIS-III, Weschler Adult Intelligence Scale-Third Edition.

Table 5
Correlations of RBANS subtests with comparable neuropsychological measures

RBANS subtest	Neuropsychological measure	Correlation value (*r*/rho)
List Learning	CVLT-II Trials 1–5 Total	.695**
Story Memory	CVLT-II Trials 1–5 Total	.420**
Figure Copy[a]	BVRT correct	.222
	BVRT errors	−.317*
Line Orientation[a]	BVRT correct	.524**
	BVRT errors	−.497**
Picture Naming[a]	MAE Visual Naming	.590**
Semantic Fluency	COWAT	.456**
Digit Span	WAIS-III Digit Span	.623**
Coding	WAIS-III Digit Symbol Coding	.827**
Delayed List Recall	CVLT-II Long Delay Recall	.753**
Delayed Story Recall	CVLT-II Long Delay Recall	.705**
List Recognition[a]	CVLT-II Recognition Hits	.381**
Delayed Figure Recall	BVRT correct	.583**
	BVRT errors	−.556**

Note: * $p < .05$; ** $p < .01$.
[a] Based on Spearman *rho* value instead of Pearson *r*.

was strongly correlated with the CVLT-II Long Delay Free Recall, as was the RBANS Story Recall. In addition, the RBANS Figure Recall showed strong correlations with both indices of the BVRT (correct and errors). The RBANS List Recognition showed a weaker, yet still significant, correlation with the CVLT-II Recognition Hits measure. Within the Language Index, both Visual Naming and Semantic Fluency were moderately correlated with the MAE Visual Naming test and COWAT, respectively. Finally, the subtests within the Visuospatial/Constructional Index were compared to the BVRT correct and error scores. The Figure Copy subtest showed a non-significant relationship with the BVRT correct score and a weak, yet significant negative correlation with the BVRT error score. The Line Orientation subtest showed stronger positive and negative correlations with the BVRT correct and error scores, respectively.

Overall, the results of these analyses supported the hypotheses. Most of the RBANS Index scores demonstrated strong internal reliability and its subtests evidenced acceptable correlations with other commonly used neuropsychological measures across various domains.

3. Discussion

The results of this study support the reliability and validity of the RBANS as a screening tool in the assessment of cognitive deficits following moderate to severe traumatic brain injury. Internal reliability was robust among most Index scores. As expected, however, the Attention and Language Index scores showed weaker reliability, as each of these indices comprises subtests that are known to be sensitive and relatively insensitive to traumatic brain injury sequelae. Specifically, coding and semantic fluency tasks are known to be very sensitive to brain injury, whereas basic attention span and confrontation naming skills are less sensitive. Therefore, the weak internal consistency shown by the Attention and Language subtests in the current TBI sample supports the sensitivity of the RBANS to the cognitive patterns usually seen in this population. Furthermore, supporting Duff et al.'s opinion (2003), this research implicates the benefits of interpreting individual subtests and making direct comparisons between them. Moreover, the results underscore the importance of understanding the impact that the individual subtests may have on the Index scores. In particular, when utilizing the RBANS as an assessment tool for individuals who have sustained a TBI, interpretation of the Attention and Language Index scores warrant consideration for the patient's performance on the respective subtests. In generally, looking at the performance on subtests may lead to a better appreciation of his or her overall profile.

The RBANS also showed strong convergent validity by its significant correlations with other comparable neuropsychological measures. All RBANS subtests demonstrated significant correlations with their counterparts. Particularly strong were the correlations within the Attention Index, which is composed of subtests tapping into the cognitive functions most often compromised and least often compromised by traumatic brain injury (Coding and Digit Span subtests, respectively). The RBANS subtests designed to assess memory functioning also showed strong correlations with various memory measures, including several CVLT-II indices. As such, these findings demonstrate that the RBANS performance with this population is commensurate with other tests known to be sensitive and insensitive to TBI sequelae.

The results of the current study add to recent research that has supported the clinical utility of the RBANS in the neuropsychological screening of neurological populations. Previous research has shown the RBANS to be a sensitive and clinically useful tool in the brief screening of cognitive deficits in various populations including dementia (Randolph, 1997), multiple sclerosis (Beatty, 2004), Parkinson's disease (Beatty et al., 2003), Huntington's disease (Randolph et al., 1998), and stroke (Larson et al., 2003, 2005). This study extends the current literature regarding the utility of the RBANS in a M–S TBI population. For example, this study expanded upon Randolph's (1998) initial findings by examining the psychometric properties of both the RBANS Index and subtest scores in a sample comprised primarily of TBI cases. Furthermore, previous research has shown the RBANS to be a superior screening measure for TBI over the MMSE and COGNISTAT (Carone et al., 2004), as well as a sensitive and reliable method for differentiating individuals with and without brain injury (Killam et al., 2005; McKay et al., 2005; Moser & Schatz, 2002). The majority of these evaluations have focused on the overall Total Scale score and Index scores and have not assessed the utility of the individual subtests. Unfortunately, this level of interpretation requires the administration and completion of every subtest, which may not be possible with every patient. Therefore, the current investigation of the reliability and validity of the individual subtests provides support for the interpretation of these subtests as valid indices of the intended cognitive function in TBI. Thus, even when it is not possible for a patient to complete an entire RBANS protocol, clinicians can still feel confident in the utility of the individual subtests to assess possible cognitive deficits and pattern of performance.

Although this study contributes to the literature supporting the use of the RBANS in TBI samples, a couple of limitations warrant mentioning. The current sample was comprised of individuals from a Midwest treatment centre who had sustained moderate to severe brain injuries with a large range in time since injury. Therefore, the generalizability of these results may be limited and thus research would benefit from replication in other populations with differing injury and demographic characteristics. For instance, future research should examine whether the clinical utility of the RBANS differs between mild and moderate to severe brain injuries. In addition, the current study utilized a specific set of neuropsychological tests to examine the convergent validity of the RBANS. Although the findings are promising, this area of research would be strengthened by further comparison of the subtests to other neuropsychological measures considered to assess similar cognitive domains (e.g., comparison of the Figure Copy and its Delay trial to the Rey Complex Figure Test and its memory indices).

In conclusion, the current study shows that the RBANS measures distinct abilities of persons who have sustained a moderate or severe brain injury and it can be used as a clinically valid and reliable tool in the brief screening of individuals who have suffered such an injury. In addition to the strong psychometric properties shown in this and previous studies, the short administration time, co-normed index scores, inclusion of a summary score, and alternate forms of the RBANS, support its use in the clinical evaluation of this population.

References

Axelrod, B. N., Fichtenberg, N. L., Liethen, P. C., Czarnota, M. A., & Stucky, K. (2001). Performance characteristics of postacute traumatic brain injury patients on the WAIS-III and WMS-III. *The Clinical Neuropsychologist*, *15*(4), 516–520.

Axelrod, B. N., Fichtenberg, N. L., Millis, S. R., & Wertheimer, J. C. (2006). Detecting incomplete effort with digit span from the wechsler adult intelligence scale-third edition. *The Clinical Neuropsychologist*, *20*(3), 513–523.

Beatty, W. W. (2004). RBANS analysis of verbal memory in multiple sclerosis. *Archives of Clinical Neuropsychology*, *19*, 825–834.

Beatty, W. W., Ryder, K. A., Gontkovsky, S. T., Scott, J. G., McSwan, K. L., & Bharucha, K. J. (2003). Analyzing the subcortical dementia syndrome of Parkinson's disease using the RBANS. *Archives of Clinical Neuropsychology*, *18*, 509–520.

Benton, A. L. (1974). *Revised benton visual retention test* (4th ed.). New York, NY: The Psychological Corporation.

Benton, A. L., Hamsher, K., & Sivan, A. B. (1978). *Multilingual aphasia examination*. Iowa City, IA: AJA Associates.

Benton, A. L., Hamsher, K., Varney, N. R., & Spreen, O. (1983). *Judgment of line orientation*. Oxford University Press, Inc.

Carone, Burns, Gold, & Mittenberg. (2004, February). A comparison of three cognitive screening tests in a traumatic brain injury sample. In *Poster session presented at the 32nd meeting of the international neuropsychological society*.

Delis, D. C., Kramer, J. H., Kaplan, E., & Ober, B. A. (2000). *California verbal learning test-second edition: Adult version*. San Antonio, TX: The Psychological Corporation.

Duff, K., Patton, D., Schoenberg, M., Mold, J., Scott, J., & Adams, R. (2003). Age- and education-corrected independent normative data for the RBANS in a community dwelling elderly sample. *The Clinical Neuropsychologist*, *17*(3), 351–366.

Duff, K., Schoenberg, M., Patton, D., Paulsen, J., Bayless, J., Mold, J., et al. (2005). Regression-based formulas for predicting change in RBANS subtests with older adults. *Archives of Clinical Neuropsychology*, *20*(3), 281–290.

Gold, J. M., Queern, C., Iannone, V. N., & Buchanan, R. W. (1999). Repeatable battery for the assessment of neuropsychological status as a screening test in schizophrenia, I: Sensitivity, reliability, and validity. *American Journal of Psychiatry*, *156*, 1944–1950.

Gontkovsky, S. T., McSwan, K. L., & Scott, J. G. (2002). Sensitivity of the semantic fluency subtest of the repeatable battery for the assessment of neuropsychological status. *Psychological Reports*, *90*, 858–860.

Kaplan, E., Goodglass, H., & Weintraub, S. (1983). *Boston naming test*. Philadelphia, PA: Lea & Febiger.

Killam, C., Cautin, R. L., & Santucci, A. C. (2005). Assessing the enduring residual neuropsychological effects of head trauma in college athletes who participate in contact sports. *Archives of Clinical Neuropsychology*, *20*, 599–611.

Larson, E. B., Kirschner, K., Bode, R., Heinemann, A., Clorfene, J., & Goodman, R. (2003). Brief cognitive assessment and prediction of functional outcome in stroke. *Topics in Stroke Rehabilitation*, *9*, 10–21.

Larson, E. B., Kirschner, K., Bode, R., Heinemann, A., & Goodman, R. (2005). Construct and predictive validity of the repeatable battery for the assessment of neuropsychological status in the evaluation of stroke patients. *Journal of Clinical and Experimental Neuropsychology*, *27*, 16–32.

McKay, C. M., Wertheimer, J. C., Fichtenberg, N. L., & Casey, J. E. (submitted for publication). The repeatable battery for the assessment of neuropsychological status (RBANS): Clinical utility in a traumatic brain injury sample.

Moser, R. S., & Schatz, P. (2002). Enduring effects of concussion in youth athletes. *Archives of Clinical Neuropsychology*, *17*, 91–100.

Meyers, J. E., & Meyers, K. R. (1995). *Rey complex figure test and recognition trial*. Odessa, FL: Psychological Assessment Resources, Inc.

The Psychological Corporation. (1997). Wechsler adult intelligence scale (3rd ed.). San Antonio, TX.

Randolph, C. (1997). Differentiating vascular dementia from alzheimer's disease: The role of neuropsychological testing. *Clinical Geriatrics*, *5*, 77–86.

Randolph, C. (1998). *Repeatable battery for the assessment of neuropsychological status (RBANS)*. San Antonio, TX: Psychological Corporation.

Randolph, C., Tierney, M. C., Mohr, E., & Chase, T. N. (1998). The repeatable battery for the assessment of neuropsychological status (RBANS): Preliminary clinical validity. *Journal of Clinical and Experimental Neuropsychology*, *20*(3), 310–319.

Tombaugh, T. (1996). *Test of memory malingering (TOMM)*. New York: Multi Health Systems.