The Repeatable Battery for the Assessment of Neuropsychological Status May Be Valid in Men

Ages 18 to 20

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Summary

The Repeatable Battery for the Assessment of Neuropsychological Status provides standardized scores for adults age 20 to 89. However, there are situations in which the use of the battery for adults aged 18-20 may be appropriate and have practical advantages. Thus, at present, an examiner who uses the battery for adult patients must rely on an entirely different evaluation tool for those adult patients under the age of 20 years. This preliminary investigation suggests the Repeatable Battery for the Assessment of Neuropsychological Status is a valid measure for men aged 18-20 years.

For years, clinicians and researchers examined neuropsychological functioning using extensive batteries such as the Halstead-Reitan and Luria-Nebraska (Groth-Marnat, 2005; Kane, Parsons, Goldstein, & Moses, 1987; Kats & Goldstein, 1993; Larrabee, Millis, & Myers, 2008; Mittenberg, Kasprisin, & Farage, 1985; Steinmeyer, 1984; Sweeney, Slade, Ivins, Nemeth, Ranks, & Sica, 2007). One recent measure that may have some advantages due to its reduced time of administration is the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS; Randolph, 1998; Randolph, Tierney, Mohr, & Chase, 1998). The battery includes 12 subtests that purport to measure functioning in five domains of neurocognitive status: Immediate Memory, Visuospatial/Constructional, Language, Attention, and Delayed Memory in people aged 20 to 89 years.

In the past decade, researchers have documented the psychometric properties of the battery in various samples, such as its factor structure, construct validity, predictive validity, and reliability (Carlozzi, Horner, Yang, & Tiley, 2008; Duff, Langbehn, Shoenberg, Moser, Baade, Mold, & Adams, 2006; Pachet, 2007; Schmitt, Livingston, Smernoff, Reese, Hafer, & Harris, 2010). This study examines the basic properties of the RBANS in a sample of adults below the age range of the published normative sample. This may be especially useful considering the reported rate of neuropsychological evaluations on individuals under the age of 20. For example, many people enlist for military service at the age of 18 and enter active combat zones where traumatic brain injuries are common. Others enter college at 18 years of age where they participate in head-contact sports. Because the battery is designed for repeated administration over time, it is a valuable tool for both of these applications, where comparisons to previous test scores are required to determine whether change has occurred as a result of injury or as a result of improvement through rehabilitation. Knowing if the RBANS is a valid tool for screening five

domains of neurocognitive functioning in these individuals could prove valuable for organizations such as the Department of Veterans Affairs and university clinics and hospitals, as well as for sports medicine providers. There is also some support for the idea there is no logical reason for significant differences to exist between those 18-20 years old and those over 20 years old. For example, the Wechsler Memory Scale, 4th edition (WMS-IV), utilizes nearly identical scoring criteria and normal score conversion for those 18-19 years old and those 20-22 years old (Wechsler, 2009).

The present study utilizes data obtained as part of a larger study on head-contact sports and academic achievement that did not achieve significant results (Strunk, 2009). This sample contained data from people less than 20 years of age and more than 20 years of age, so it was deemed appropriate for examining the appropriateness of the existing norms for those under 20 years old. It was hypothesized that the overall scaled scores would be within the average range (i.e., $M = 100 \pm 15$; one standard deviation) based on existing norms and that the battery subtest and total scores would be similar to those in the next closest age group (i.e., ages 20-22 years).

METHOD

Participants

Male participants ($n = 47$) were recruited from two Midwestern universities and were paid US \$10.00¹ for completing a study on the neuropsychological status of men who participated in head-contact sports compared with those who did not participate in head-contact sports. This volunteer sample consisted of participants were recruited from undergraduate

¹ Although it is somewhat unusual for financial incentives to be offered for undergraduate students' participation in research because they are usually offered course credit for their participation, it was not possible to offer credit to women because there were insufficient numbers of women involved in head contact sports; therefore, many faculty were not comfortable offering course credit when around half of their students would be unable to participate.

psychology courses and the football team at a small Midwestern Christian university, as well as the ice hockey team at a mid-sized state university. One participant was removed because of opioid pain reliever use and an inability to successfully complete test construction tasks. A second was excluded because he reported a severe neurological disorder, leaving a final sample size of 45. Participants' age ranged from 18 to 22 ($M = 19.78$, $SD = 1.38$). Of these participants, 24 were over the age of 20, and 21 were under the age of 20. Seven participants were seniors, eight were juniors, 16 were sophomores, and 14 were freshmen. In terms of ethnicity, 37 reported they were European-American/White, three reported they were Hispanic-American, two that they were African-American/Black, one that he was Native American, and two reported they were of an "Other" ethnicity. Twelve participants had been previously diagnosed with head trauma, while 33 had not. Six participants were from the football team, three from the ice hockey team, and the remaining 36 were not active participants in any head-contact sports. The average GPA reported was 3.36 ($SD = .52$), and the average completed credit hours reported were 47.24 ($SD = 38.68$).

Materials

Materials included an informed consent form, a demographic questionnaire, and two assessments: the RBANS Form A and the Kaufman Brief Intelligence Test, 2nd Edition (KBIT-2; Kaufman & Kaufman, 2002). Demographic questions included age, sex, ethnicity, college classification, participation in head-contact sports, number of previously treated head injuries (if any), if the participant had ever been asked not to return to play in a head-contact sport due to head injury, whether he had been diagnosed with any neurological or learning disorders, types of medications, current grade point average, and credit hours completed.

Procedure

Participants were tested in a one-hour session, which was more than adequate time for all participants to complete the informed consent process and both assessments. They were seated across from the examiner in the psychology lab, which included a table and two chairs. Upon arrival, the examiner greeted the participant, explained the procedure and answered any questions, and obtained informed consent. The tests were administered in accordance with the publishers' instructions, and were administered in counterbalanced order to control for practice and exhaustion effects. Demographic data were collected following the test administration. All participants were treated in accordance with APA ethical standards, and an institutional review board approved this procedure.

RESULTS AND DISCUSSION

The dataset was first examined for any missing variables. After confirming the completeness of the dataset, the data were analyzed to determine what, if any, relationships existed between demographic variables and the measures. The data were then analyzed for normality. Finally, the appropriateness of the established norms for those aged 18-20 was examined.

Pearson's correlations were used to examine potential relationships between the demographic variables and the measures. No demographic variables were significantly correlated (See Table 1).

Next, the KBIT-2 scores were examined to determine if the participants were of average intelligence. This was done to assess the normality of the sample in terms of IQ. The composite IQ was average ($M = 104.13$, $SD 12.61$). Skew and kurtosis were within normal limits (skew = -.262, kurtosis = -.215). A one-sample t test on the brief intelligence test composite IQ scores showed that composite IQ did significantly deviate from the standard mean of 100 ($t = 2.199$, $p =$

.033, $\eta^2 = .026$). However, the mean difference was within one standard deviation. Further, the fact that the sample trends slightly higher than the national average in terms of intelligence was somewhat expected because this sample was entirely comprised of college students. Based on the obtained value within one *SD* of average and the relatively low deviation from national norms, the sample was determined to have average intelligence.

The RBANS uses standard scores ($M = 100$, $SD = 15$). For this study, all of the standard scores were calculated using the norms for the 20-39 year old norm group. In this sample, the total scale score had a mean of 91.69 ($SD = 9.64$). The findings for the subscales were as follows: the immediate memory score had a mean of 91.52 ($SD = 10.92$), the visuospatial/constructional scale had a mean of 87.98 ($SD = 14.07$), the language scale had a mean of 95.76 ($SD = 12.15$), the attention scale had a mean of 100.84 ($SD = 13.97$), the delayed memory scale had a mean of 94.89 ($SD = 12.37$). Skew and kurtosis were acceptable for all indices except for the delayed memory scale, which was somewhat leptokurtic (1.84). For skew and kurtosis statistics, please refer to Table 2. The deviations on the battery scores were larger than the standard error of measurement, but not by more than two standard errors of measurement on any scale. All scores were within one standard deviation of the mean, as expected.

To examine the primary hypothesis, we compared the scores for our sample to the scores obtained by those in the normative sample. Because the norms start at age twenty, all participants' scores were determined based on those norms, including younger participants. To determine if any significant differences in scores existed between those aged 18 and 19 years old ($n = 21$) versus those 20-22 years old ($n = 24$), t tests were run. There were no significant differences for the total scale score ($t = -.016$, $p = .987$, $\eta^2 < .001$), immediate memory ($t = -.059$,

$p = .953$, $\eta^2 = < .001$), visuospatial/constructional ($t = -.923$, $p = .361$, $\eta^2 = .019$), language ($t = .737$, $p = .465$, $\eta^2 = .013$), attention ($t = -.804$, $p = .426$, $\eta^2 = .015$), or delayed memory ($t = 1.173$, $p = .247$, $\eta^2 = .031$) scales. These analyses indicated that the age groups were not significantly different in terms of any battery scales, partially supporting the appropriateness of the existing lower age group battery norms for adults ages 18-19. In conclusion, the data from a small sample adds to published studies about the validity of the RBANS as a brief measure of neuropsychological functioning and suggests that the test can be used with caution in adults ages 18 to 19 and that the normative data from the test manual will provide useful information until a large-scale study can provide more definitive results.

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Table 1

Correlations Between Demographic Variables, Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), and Kaufman Brief Intelligence Test-2 (KBIT-2)

	Age	Academic Year	Credit Hours
KBIT-2			
Verbal Intelligence	-.037	-.088	.133
Nonverbal Intelligence	-.025	.064	.106
Composite IQ	-.035	.093	.145
RBANS			
Immediate Memory	.095	.153	.183
Visuospatial/Constructional	.162	.128	.194
Language	.060	.103	.085
Attention	.182	-.029	.056
Delayed Memory	-.255	-.221	-.278
Total Scale Score	.092	.037	.075

Table 2

Descriptive Statistics for the Kaufman Brief Intelligence Test-2 (KBIT-2) and Repeatable Battery for the Assessment of Neuropsychological Status (RBANS)

	<i>M</i>	<i>SD</i>	Skew	Kurtosis
KBIT-2				
Verbal Intelligence	106.24	11.26	.448	.234
Nonverbal Intelligence	100.47	14.70	-.018	-.242
Composite Intelligence	104.13	12.61	-.262	-.215
RBANS				
Immediate Memory	91.53	10.97	.763	-.427
Visuospatial/Constructional	87.98	14.07	.609	.052
Language	95.76	12.15	-.246	-.280
Attention	100.84	13.97	-.911	.835
Delayed Memory	94.89	12.37	-.852	1.840
Battery Total Scale	91.69	9.64	.498	.491

Table 3

Descriptive Statistics for the Kaufman Brief Intelligence Test-2 (KBIT-2), and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) by Head Trauma Grouping

	Prior Head		No Prior Head	
	Trauma		Trauma	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
KBIT-2				
Verbal Intelligence	103.83	11.15	107.12	11.33
Nonverbal Intelligence	95.58	17.29	102.23	13.48
Composite Intelligence	100.00	14.27	105.64	11.82
RBANS				
Immediate Memory	91.00	10.89	91.73	11.15
Visuospatial/Constructional	88.58	15.95	87.76	13.59
Language	92.08	13.49	97.09	11.55
Attention	97.00	15.60	102.24	13.30
Delayed Memory	92.42	13.08	95.79	12.17
Battery Total Scale	89.17	9.40	92.61	9.69