A Reflective Review of the RBANS

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Abstract: *The field of neurology and neurological testing is constantly evolving and changing. The present article reviews one contemporary test and provides a brief overview of some of the uses of the test, with certain specific populations. It also discusses some factor analytic studies regarding the test and its uses with different populations.*

Keywords: *Neurological Assessment, Brief Screening, RBANS.*

1. INTRODUCTION

The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) is a recently developed tool for neuropsychological assessment. It was developed by Randolph (1998) and some preliminary clinical validity has been provided by Randolph, Tierney, Mohr and Chase (1998). Their sample sizes were small, but this provided the field with preliminary data and investigatory information regarding the RBANS Weber (2003) has found that the RBANS has reasonable test-retest reliability in schizophrenia. Wilde (2006) also found the validity of the repeatable battery of neuro psychological status in acute stroke. Beatty (2004) employed the RBANS in terms of assessing verbal memory in multiple sclerosis. Beatty, Ryder, Gontkovsky, Scott McSwan & Bharucha (2003) utilized the RBANS to analyze the subcortical dementia aspects of Parkinson's disease. Mooney, et al (2007) employed the RBANS in patients with end-stage liver disease awaiting a liver transplant. Gold, Queern, Iannone and Buchanan (1999) have also used the RBANS as a screening test in schizophrenia and examined reliability, validity and sensitivity. Patton, Duff, Schoenbergg, Mold, Scott and Adams (2003) examined the performance of "cognitively normal" African Americans on the RBANS in a community setting with older adults.

2. OVERVIEW

2.1. The RBANS has been Utilized and Employed with a Wide Variety of Conditions

The RBANS is a quite useful tool due to its brevity and its portability. Administration requires about 20-30 minutes and the test can be administered in various settings including bedside administration.

2.2. The RBANS Provides Distinctly Different Scores for Various Cognitive Domains

There are five specific indices which are measured/assessed/evaluated by 12 subtests: 1) An Immediate Memory Index, 2) Visuospatial Construction Index- assessed via complex figure copy and line orientation, 3) A global Language Index- evaluated by picture naming and semantic fluency, 4) An Attentional Index- assessed by Digit Span and Coding and 5 A Delayed Recall Index which is evaluated via list recall/recognition/story recall and lastly a complex figure recall. Some of the most relevant studies regarding the RBANS will now be reviewed.

2.3. The RBANS to Assess and Evaluate Cognitive Change in Patients with Huntington Disease

Begliner, Duff, Allison, Theriault, O'Rourke, Leserman and Paulsen (2010) utilized the RBANS to assess and evaluate cognitive change in patients with Huntington Disease. As is known, Huntington is a neuro-degenerative problem that impacts cognition, motor skills and later shows psychiatric indicators over time. A sample of 38 patients was evaluated utilizing the RBANS and the RBANS was found to be quite useful in terms of assessing and evaluating change over time. There were two separate assessments approximately 16 months apart and the RBANS measured Attention Index and subtest scores on Coding, Digit Span, List Recognition and Figure Copy and Recall all

declined during this time period. Carlozzi, Horner, Yang and Tilley (2008) conducted a factor analytic study of the RBANS using a sample of 175 veterans. They did not identify a five factor structure however, memory and visual spatial function was found using a Confirmatory Factor Analysis. Carlozzi and his associates indicated that it may be more helpful for clinicians to focus on the \individual subtest scores than the larger index scores in terms of interpretation and rehabilitation planning.

2.4. The Use of the RBANS-H with Hearing Impaired

Claes, Van de Heyning. Giles. Van Rppaey & Mertens in 2018 investigated the use of the RBANS-H with hearing impaired. As is known, hearing loss has accelerated cognitive decline and cognitive impairments in older adults. Cochlear implantation happens to be an efficient solution to positively impact communication, and quality of life, for patients with hearing impairment. Roughly, twenty older adults were evaluated before and after cochlear implantation. The Repeatable Battery for the Assessment of Neuropsychological Status for Hearing-impaired individuals (RBANS-H), is an audio-visual cognitive assessment tool which provides a total score of cognition and five index scores. After 12 months of cochlear implantation usage, the RBANS-H total scores improved significantly (p<0.001). In index level, the improvements were observed in the Immediate and Delayed memory domain (p=0.005 and p=0.002), also in lesser extent in Attention domain (p=0.047). Overall, there was significant improvement in cognition after 12 months of cochlear implantation; speech perception and patient reported measures were confirmed Duff, Berlinger, Kettmann and Bayless (2006) employed a case study approach in a case of pre-and post-right middle cerebral artery stroke in a young adult, which examined the sensitivity of the RBANS with stroke patients. They noted that the Visuospatial/ Constructional index was one of the most helpful indicators of right hemisphere problems. It was noted that the RBANS was helpful in spite of previous psychiatric problems.

2.5. The RBANS as a Screening Battery

Duff, Jenks, and Bayless (2006) employed the RBANS as a screening battery, the Repeatable Battery for the Assessment of Neuro psychological Status which is a test which has been researched and examined for validity. In this particular case, it was measured for accuracy after being administered to a young

adult with a complex psychiatric history that suffered a Pre- and Post-Right Middle Cerebral Artery Stroke. This test measures attention, language, visuospatial/constructional abilities, and intermediate and delayed memory. The patient was evaluated and the comparisons between pre- and post-stroke cognitive scores showed a major decline in tasks assessing nonverbal abilities, arithmetic, and processing speed. The most significant change was found by the RBANS Visuospatial/Constructional index, which showed declines in Figure copy and Line orientation. In the existing literature, RBANS has been criticized for being limited in executive measures and for making modifications to Line Orientation tests, which can possibly weaken its sensitivity. Despite those concerns, the test within this particular case study has a validated sensitivity when measured against the traditional neuropsychological measures. Lastly, it is important to note that even though RBANS has a validated sensitivity in this specific case, the author is not suggesting that the RBANS is an adequate stand-in for neuropsychological evaluation. The reason behind that is because without the combined measures, the understanding of the patient's intellectual skills, executive functioning, mood and effort would not be complete (Duff, Jenks, and Bayless 2006). Duff, Schoenberg, Beglinger, Moser, Bayless, Culp, Carnahan, Mold, Scott and Adams (2008) examined premorbid intellect and current RBANS performance in terms of discrepancy scores in three separate geriatric samples. For clinicians, it is often important to measure cognitive decline over time. It is important to keep data for documentation purposes and the RBANS is an excellent tool for rapidly assessing overall cognitive functioning. The authors caution however, that it should not substitute for a comprehensive neuropsychological evaluation.

2.6. A Premorbid Assessment was Determined Using the BARONA Methodology

It should be noted that the BARONA method is simply a gross overall estimate of premorbid functioning. It was also noted that the RBANS is NOT an intellectual or cognitive assessment and in many instances it is important to have a full I.Q. test such as the Wechsler or Stanford Binet 5 administered by a competent professional Duff, Schoenberg, Mold, Scott and Adams (2011) explored the domain of gender differences on the RBANS in a large sample of males (n=300) and females (n=418) These

adults were primary care patients and age and education were controlled for in this study. Significant differences were ascertained on 9 of the various subtests. The authors did indicate that there were some significant limitations to their study. The sample was predominately Caucasian and well educated and availed themselves of primary care physicians. Thus generalization is limited. The authors further indicate that there is no specific measure of fine or gross motor skills in the RBANS.

2.7. The RBANS for Post-Stroke Cognitive Impairment Screening

Green, Sinclair, Rodgers, Birks and Lincoln (2013) employed the RBANS for post-stroke cognitive impairment screening. As is commonly known there are often numerous and multiple cognitive and other problems following a stroke? The RBANS test was used in the case of 60 patients to detect post-stroke cognitive impairment. The participants consisted of 60 patients from acute stroke-wards who were no older than 80 years old. There was a comparison between the RBANS total and index scores, and the types of impairment on the Neuro psychological test battery in the following areas: attention, visuospatial perception, delayed memory, immediate memory, language, and executive functioning. The results demonstrated that the RBANS did not have a great amount of sensitivity but did have good specificity for finding any cognitive impairment. Also, the results show that the RBANS total index could tell the difference between participants with cognitive impairment and from those without any cognitive impairment after a stroke. The participants who scored below 70 points were more likely to have cognitive impairment. There were also some imitations to this study, including the fact that screening for cognitive problems in the first few days after a stroke might detect temporary problems. Overall, the results suggest that RBANS is a proper screening test for post-stroke cognitive impairment. It is also essential to consider that standard cognitive tests and measures can underestimate executive dysfunction after a stroke. Identifying cognitive impairment is crucial for the rehabilitation process and for being able to cope with those post-stroke cognitive impairments. Heyanks, Scott and Adams (2015) endeavored to enhance and improve the clinical and diagnostic accuracy of the RBANS in a group with no diagnosis (ND) (n=68) those diagnosed with Alzheimer's disease (AD) n= 24 and patients diagnosed with

Mild Cognitive Impairment (MCI) (n=57). They employed a stepwise logistical regression and found that when the addition of "construct similar" neuropsychological tests assisted in the diagnostic aspects of RBANS when endeavoring to spot more subtle cognitive weaknesses in those with MCI. Data regarding the Stepwise Logistic Regression in MCI versus AD groups was provided. They provided some suggestions for future relevant research- specifically in the realms of executive functioning and sensorimotor. Niccolai and his co-workers (2015) employed an alternative to the RBANS using a Brief International Cognitive Assessment for Multiple Sclerosis (BICAMS) as well as a Brief Repeatable Battery (BRB). It is important for clinicians to be able to compare and contrast alternatives to the RBANS and discern if other measures are more appropriate for certain groups.

2.8. The Use of the RBANS in the Realm of Depressive Complaints in Older Adults

Hook, Han and Smith (2010) examined the use of the RBANS in the realm of depressive complaints in older adults. A sample of 45 older adults were administered the Geriatric Depression Scale and RBANS Immediate Memory Index. This study used a clinical sample of 45 subjects (a geriatric sample), where there was a negative correlation found between depression scores and the RBANS test. The average age of the participants was 75.44, also their average years of education were 13.34. The majority of the participants were Caucasian, right-handed, and married or widowed. There were more females than males and four of the patients were receiving treatment for depression or anxiety at the time of the study. The patients were also taking an average of 7.64 prescribed or over the counter medications. They also had a wide range of medical diagnoses. In this particular sample, the RBANS contained subtests that consisted of 1) Immediate Memory Index, 2) Attention Index, 3) Visuospatial/constructional Index, 4) Language Index, 5) Delayed Recall Index and 6) Total Scale Score (Hook, Han, & Smith, 2010). The results of this exploratory investigation indicated that the higher depression scores were directly related to bad performance on the RBANS Immediate Memory Index. Depression was also found to be related to performance on list learning, but not the Story Memory. Overall, the findings demonstrate that in a geriatric sample of mostly medically ill patients, depression has limited correlations to their performance on the RBANS.

2.9. The RBANS Factor Structure was Appropriate in the Realm of Inpatient Psychiatry

King, Bailie, Kinney, Nitch (2012) attempted to ascertain if the RBANS factor structure was appropriate in the realm of inpatient psychiatry. Their study employed a sample of inpatients with schizophrenia or schizoaffective disorder (n-167). The results were not consistent with the five factor structure of the RBANS. The authors found two factors- namely a memory dimension and a visual perception and also a processing speed dimension. The authors echo the work of Iverson, Brooks and Haley (2009) in terms of interpreting the RBANS in the realm of inpatient psychiatry. Apparently, as a generalization there seems to be a prevalence of low scores for individual patients with schizophrenia Larson, Kirschner, Bode, Heinemann and Goodman (2005) endeavored to examine and explore the construct and the predictive validity of the RBANS in the evaluation of stroke patients. Lippa, Lange, Bhagwat and French (2017) recently examined the clinical utiity of embedded performance validity tests on the RBANS on patients who suffered a mild traumatic brain injury. The Effort Index and the Effort Scale were focused on in this study. Mossbarger, Whitney, Herman and Mariner (2012) employed the RBANS and various screening measures (the Mini Mental State Exam) and Montreal Cognitive Assessment. Mossbarger and his colleagues raise the concern that there may be "practice effects when using more than one test- as repeated tests may sensitive clients or patients to the skill set required of a certain task. They note that the RBANS is a multiple domain instrument but that it also has two forms A and B and clinicians should be aware of this. A mini mental status exam does not seem to overlap or cause interference or difficulty when administered in conjunction with the RBANS. However, the authors noted some concern about the Montreal Cognitive Assessment (Nasreddine et al 2005)

2.10. Analytic Study of the RBANS (N= 636)

Schmitt Livingston, Smernoff, Reese, Hafer and Harris (2010) also conducted a factor analytic study of the RBANS (n= 636). They noted that the factor structure was formed basically from a theoretical perspective, and while reasonable, there was at that time little empirical evidence to support that particular factor structure. Subject pools of 636 subjects were given the RBANS (which has a mean of 100 and a standard deviation of 15). Various subtests from the Wechsler scales were administered (Vocabulary, Similarities, Block Design and Matrix Reasoning) as well as various supplemental measures such as phoenemic fluency, semantic fluency, Clock Drawing and MMSE. Means and Standard Deviations were reported. The authors caution that their sample does not reflect national demographics. Essentially Schmitt and his associates felt that a two factor perspective was the most efficacious. Thaler, Hill, Duff, Mold and Scott (2015) employed the RBANS to examine intra individual variability in a number of older adults and endeavored to explore associations with disease and mortality. Further- self- reported measures of memory problems were also investigated. There was some concern that RBANS scores could be impacted by major medical problems but could also be related to "terminal drop" or functional decline as one approaches death. Vogt, Prichett and Hoelzle (2017) investigated 5 samples of data from 4 previously published studies and from a new clinical sample and found an invariant two component structure. Vogt and her associates caution that "clinicians should recognize that interpretation of a single subtest to represent a cognitive construct is neither optimally reliable nor sensitive and may ultimately negatively impact the clinical utility of the measure "(p.59) A ceiling effect with Picture Naming was indicated. The authors recommend expansion of the Digit Span task to include backwards and sequencing elements. The authors also suggest that prior methodological decisions could have impacted earlier research. Lastly the authors suggest supplemental language tests (perhaps both expressive and receptive language to more accurately discern difficulties with that construct and communication difficulties. Zhang and his colleagues (2015) looked at neuropsychological impairment in prodromal, first episode and chronic psychosis, and employed the RBANS to examine these groups. The groups included healthy volunteers (n= 28) subjects at "high risk" for clinical psychosis (n=27) first episode schizophrenia patients (n=26) and long term chronic schizophrenia (n=147). The unequal sample size should obviously be noted. RBANS scores were found to decline with disease progression. Apparently baseline difficulties in delayed memory seemed to predict conversion to a psychotic state, at least in this research. The authors indicate that there is a serious need to monitor and treat memory functioning in those afflicted with various psychotic states during the various stages of the disease.

2.11. Hearing Loss has Accelerated Cognitive Decline and Cognitive Impairments in Older Adults

Cochlear implantation happens to be an efficient solution to positively impact on communication and quality of life, for patients with hearing impairment. Roughly, twenty older adults were evaluated before and after cochlear implantation. The Repeatable Battery for the Assessment of Neuropsychological Status for Hearing-impaired individuals (RBAN- H), is an audio-visual cognitive assessment tool which provides a total score of cognition and five index scores. After 12 months of cochlear implantation usage, the RBANS-H total scores improved significantly ($p<0.001$). In index level, the improvements were observed in the Immediate and Delayed memory domain ($p=0.005$ and $p=0.002$), also in lesser extent in Attention domain ($p=0.047$). Overall, there is significant improvement in cognition after 12 months of cochlear implantation; speech perception and patient reported measures were confirmed (Claes, Van de Heyning, Giles, Van Rompaey, & Mertens 2018). Gogos, Joshua & Rossell, (2010) utilized the RBANS as a type of screening test and the assessment was performed on a group of schizophrenic and bipolar patients. This group was compared to a healthy group of individuals. The main goals of the study were to: investigate deficits in neuro-cognition using the RBANS, comparing schizophrenia and BD to a healthy non-psychiatric control group, and to investigate the effects of gender on neuro-cognition in schizophrenia, BD and control participants which were specifically matched for gender. During the test, the patients with schizophrenia were taking a higher dose of antipsychotic medication than were the BD patients. Some BD and Schizophrenic patients also took a combination of antipsychotic and mood stabilizers/ antidepressants. The tests that were performed on all of the patients, including the control group, were ones that addressed: immediate memory/learning, visuospatial/ constructional, language, attention, and delayed memory.

3. RESULTS

The RBANS total score results showed that the schizophrenic patients performed worse than BD patients and the controls. In addition, though there were no drastic gender differences, there were some group and gender interactions. The BD patients test performance was better in females compared to males. Female and male control or schizophrenia patients showed a similar performance.

4. SUMMARY AND CONCLUSIONS

The RBANS is a quite useful measure that can be employed in a wide variety of situations and is an instrument that has now been extensively researched and reviewed. As with all clinical instruments, training in the instrument, supervised experience and experience with a wide variety of clinical conditions is imperative for accurate reliable results. While there is some concern about factor analytic studies, the existing research does seem to overall suggest the RBANS has an effective use and yields relevant salient and germane conditions an should continue to be used with results and case studies discussed and distributed.

REFERENCES

[1] Beatty, W.EW. (2004) RBANS analysis of verbal memory in multiple sclerosis. Archives of a. Clinical Neuropsychology, 19 (6), 825-834.

[2] 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 using the RBANS. Archives of Clinical Neuropsychology, 18 (5), 509- 520.

[3] Beglinger, L. J., Duff, K., Allison, J., Theriault, D., O'Rourke, J. J. F., Leserman, A., & Paulsen, J. S. (2009). Cognitive change in patients with Huntington disease on the Repeatable Battery for the Assessment of Neuropsychological Status. Journal of Clinical and Experimental Neuropsychology, 32(6), 573–578. https://doi.org/10.1080/13803390903313564

[4] Carlozzi, N. E., Horner, M. D., Yang, C., & Tilley, B. C. (2008). Factor Analysis of the Repeatable Battery for the Assessment of Neuropsychological Status. Applied Neuro psychology, 15(4), 274–279. https://doi.org /10.1080/09084280802325124

[5] Claes, A., Van de Heyning, P., Gilles, A., Van Rompaey, V., & Mertens, G. (2018). Cognitive performance in severely hearing-impaired older adults before and after cochlear implantation: preliminary results of a prospective, longitudinal cohort study using the RBANS-H. Journal of Hearing Science, 8(2), 381.

[6] Duff, K., Beglinger, L. J., Jenks Kettmann, J. D., & Bayless, J. D. (2006). Pre- and Post-Right Middle Cerebral Artery Stroke in a Young Adult: A Case Study Examining the Sensitivity of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Applied Neuropsychology, 13(3), 194–200.

[7] Duff, K., Schoenberg, M. R., Beglinger, L. J., Moser, D. J., Bayless, J. D., Culp, K. R., . . . Adams, R. L. (2008). Premorbid Intellect and Current RBANS Performance: Discrepancy Scores in Three Geriatric Samples. Applied Neuropsychology, 15(4), 241–249. https://doi.org/10.1080/09084280802325041

[8] Duff, K., Schoenberg, M. R., Mold, J. W., Scott, J. G., & Adams, R. L. (2010). Gender differences on the Repeatable Battery for the Assessment of Neuropsychological Status subtests in older adults: Baseline and retest data. Journal of Clinical and Experimental Neuropsychology, 33(4), 448–455. https://doi.org/10.1080/13803395.2010.533156

[9] Galit Liffshiz & Associates. (2015, April 9). Repeatable Battery for Neuropsychological Status (RBANS): A Screening Tool Following Head Injury – Galit Liffshiz & Associates. Retrieved November 26, 2018, from http://gla-rehab.com/repeatable-battery-for-neuropsychological-status-rbans-a-screening-tool-following-head-injury/

[10] Gogos, A., Joshua, N., & Rossell, S. L. (2010). Use of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) to investigate group and gender differences in schizophrenia and bipolar disorder. The Royal Australian and New Zealand College of Psychiatrists, 220–229.

[11] Gold,, J.M., Queern, C. Iannone, V.N., & Buchanan, R.W. (1999) Repeatable battery for the Assessment of Neuropsychological Status as a screening tool in schizophrenia, I : Sensitivity, reliability, and validity. American Journal of Psychiatry. 156, 1937-1950

[12] Green, S., Sinclair, E., Rodgers, E., Birks, E., & Lincoln, N. (2013). The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) for post-stroke cognitive impairment screening. International Journal of Therapy and Rehabilitation, 20(11), 537–542.

[13] Heyanka, D. J., Scott, J. G., & Adams, R. L. (2013). Improving the Diagnostic Accuracy of the RBANS in Mild Cognitive Impairment with Construct-Consistent Measures. Applied Neuropsychology: Adult, 22(1), 32–41. https://doi.org/10.1080/23279095.2013.827574

[14] Hook, J. N., Han, D. Y., & Smith, C. A. (2010). Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) and Depressive Complaints in Older Adults. Clinical Gerontologist, 33(2), 84–91. https://doi.org/10.1080/07317110903552164

[15] Iverson,G.L, Brooks, B.L., Haley, G.M.T.(2009) Interpretation of the RBANS in inpatient psychiatry: Clinical normative data and prevalence of low scores for patients with schizophrenia. Applied Neuropsychology. 16, 31-41.

[16] King, L. C., Bailie, J. M., Kinney, D. I., & Nitch, S. R. (2012). Is the Repeatable Battery for the Assessment of Neuropsychological Status Factor Structure Appropriate for Inpatient Psychiatry? An Exploratory and Higher-Order Analysis. Archives of Clinical Neuropsychology, 27(7), 756–765. https://doi.org/10.1093/arclin/acs062

[17] 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(1), 16–32. https://doi.org/10.1080/138033990513564

[18] Lippa, S. M., Lange, R. T., Bhagwat, A., & French, L. M. (2016). Clinical utility of embedded performance validity tests on the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) following mild traumatic brain injury. Applied Neuropsychology: Adult, 24(1), 73–80. https://doi.org/10.1080/23279095.2015.1100617

[19] Mooney, S. Hasssanein, T.L., Hilsabeck,R.C. Ziegler, E.A. Carlson,M. , Maron L.M. et al (2007) Utility of the repeatable battery for the assessment of neuropsychological Status (RBANS) In patients with end-stage liver disease awaiting liver transplant. Archives of Clinical neuropsychology, 22 (2) , 175-186

[20] Mossbarger, B., Whitney, K. A., Herman, S. M., & Mariner, J. E. (2012). Evidence of Carry-Over in Memory Test Batteries Using RBANS and Screening Measures. Applied Neuropsychology: Adult, 19(1), 38–41. https://doi.org/10.1080/09084282.2011.643939

[21] Nasreddine, Z.S., Phillips, N.A. Bedirian,A. Charbonneau, S., Whitehead, V Collins,I, Hertktow H. (2005) The Montreal Cognitive Assessment , MoCA: A brief screening tool for mild cognitive impairment Journal of the American Geriatrics Society. 53. 695-699.

[22] Niccolai, C., Portaccio, E., Goretti, B., Hakiki, B., Giannini, M., Pastò, L., . . . Amato, M. P. (2015). A comparison of the brief international cognitive assessment for multiple sclerosis and the brief repeatable battery in multiple sclerosis patients. BMC Neurology, 15(1), 1–5. https://doi.org/10.1186/s12883-015-0460-8

[23] Patton, D.E. Duff, K. Schoenberg, M.R. Mold, J., Scott, J.G. and Adams, R.L (2003) Performance of cognitively normal African Americans on the RBANS in community-dwellng older adults. Clinical Neuropsychologist 17, 515-530

[24] Randolph, C. (Ed.) (1998) Repeatable Battery for the Assessment of Neuropsychological a. Status (manual) San Antonio, Texas: The Psychological Corporation

[25] Randolph, C., Tierney, M. C., Mohr, E., & Chase, T. N. (1998). The Repeatable Battery for the Assessment of Neuropyschological Status (RBANS): Preliminary Clinical Validity*. Journal of Clinical and Experimental Neuropsychology, 20(3), 310–319.

[26] Schmitt, A. L., Livingston, R. B., Smernoff, E. N., Reese, E. M., Hafer, D. G., & Harris, J. B. (2010). Factor Analysis of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) in a Large Sample of Patients Suspected of Dementia. Applied Neuropsychology, 17(1), 8–17. https://doi.org/10.1080/09084280903297719

[27] Thaler, N. S., Hill, B. D., Duff, K., Mold, J., & Scott, J. G. (2015). Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) intraindividual variability in older adults: Associations with disease and mortality. Journal of Clinical and Experimental Neuropsychology, 37(6), 622–629. https://doi.org/10.1080/13803395.2015.1039962

[28] Vogt, E. M., Prichett, G. D., & Hoelzle, J. B. (2016). Invariant two-component structure of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Applied Neuropsychology: Adult, 24(1), 50–64. https://doi.org/10.1080/23279095.2015.1088852

[29] Weber, B (2003) RBANS has reasonable test-retest reliability in schizophrenia. Evidence – Based Mental Health 6, 22.

[30] Wilde, M.C. (2006). The validity of the repeatable battery of neuropsychological status in acute stroke. The Clinical Neuro psychologist, 20 (4), 702-715.,

[31] Zhang, T., Li, H., Stone, W. S., Woodberry, K. A., Seidman, L. J., Tang, Y. . . . Wang, J. (2015). Neuropsychological Impairment in Prodromal, First-Episode, and Chronic Psychosis: Assessing RBANS Performance. PLOS ONE, 10(5), 1–13. https://doi.org/10.13 71/journal.pone.0125784