

CAVEATS IN THE NEUROPSYCHOLOGICAL ASSESSMENT OF AFRICAN AMERICANS

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This preliminary investigation examined the predictive accuracy of six neuropsychological tests in a population of non-brain-injured African Americans. False positives were unacceptably high on five of the neuropsychological tests administered. These pilot data raise important questions about the utility of neuropsychological test norms with groups dissimilar in socio-cultural background to the normative population. These findings are examined in terms of the relative merits of the race-homogenous and race-comparative paradigms and underscore the importance of conducting normative studies that involve ethnic minority populations. (*J Natl Med Assoc.* 2002;94:591-601.)

I am an invisible man. No, I am not a spook like those who haunted Edgar Allan Poe; nor am I one of your Hollywood movie ectoplasms. I am a man of substance, of flesh and bone, fiber, and liquids—and I might even be said to possess a mind. I am invisible, understand, simply because people refuse to see me. Like the bodiless heads you

see sometimes in circus sideshows, it as though I have been surrounded by mirrors of hard, distorting glass. When they approach me they see only my surroundings, themselves, or figments of their imagination—indeed, everything and anything except me. (p.7)

This passage from the prologue of Ellison's 1952 novel, *Invisible Man*,¹ describes the dehumanization, degradation, and outright neglect that the protagonist encountered as an African American male in the United States. Five decades later, these social conditions and the invisibility of African Americans in the United States still persist.

To a very large degree, mainstream psychology is shaped by the traditions and viewpoints of Euro-American thought.^{2,3} Consequently, behavioral and social scientists often view African Americans and other ethnic minorities in terms prescribed by the normative behavior of Euro-Americans.⁴⁻⁶ This ethnocentric bias not

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only leads to spurious interpretations of psychological findings, but it also imposes constraints on the definitions and measurement of psychological processes and competencies in African Americans. This truncated perspective ignores the view that the African American cultural experience, as a separate entity, goes beyond the boundaries of class differences, contributing independently and uniquely to the development of psychological processes.

In the cognitive neurosciences, very few studies have examined higher cortical functions in African Americans with confirmed cerebral lesions.⁷⁻¹⁰ The lack of interest shown to issues that relate to brain-behavior functions in brain-damaged African Americans is especially noteworthy in light of accumulating findings which show that ethnicity and culture are important determinants of performance on measures of higher brain functions.^{2,7,11-15} Recent studies examining cognitive functions in African Americans with or without diagnoses of medical pathology underscore this point. Ethnicity and culture have proven important variables in studies of cognitive impairment in HIV positive African Americans¹⁶ and elderly African Americans.¹⁷ Several studies have examined performances of African Americans on various neuropsychological tests and have recommended that their scores be corrected for ethnicity and other demographic factors.¹⁸⁻²³ Diverse variables may mediate the impact of ethnicity on cognitive test performances among African Americans, including acculturation,¹⁶ socioeconomic status, education, experiences of racism,²⁴ and literacy.²⁵

In clinical and experimental neuropsychology, the currently accepted model of higher cortical functions also is derived primarily from studies of Euro-Americans.^{15,26} This model is lacking in its ability to conceptualize neuropsychological functioning beyond the narrow parameters established by the behavior of Euro-Americans. Any attempt, therefore, to understand brain-behavior relations in African Americans without placing the ideals, behaviors, value orientations, and cultural traditions

of African Americans at the center of the analysis will be incomplete at best.

The present report examines, in a non-brain-injured population of African Americans, the diagnostic accuracy of several neuropsychological measures. The level of performance approach (i.e., cutoff scores) for neuropsychological test interpretation provides the context in which this issue is addressed (see method section).²⁷

METHOD

Subjects

Seventy-one right-handed African Americans (43 females and 28 males) participated in this pilot investigation. These persons served as normal controls in a study that examined the effects of lateralized lesions on a battery of neuropsychological tests. The participants, self-identified as African American, were selected from a population of in-patients and out-patients in the Physical Medicine and Rehabilitation Service (PM & R) at Howard University Hospital. They were being treated for injuries that did not involve the brain. In an interview, these participants denied a history of previous brain insults, psychiatric illness, alcohol or any other drug abuse. The mean age of this group was 49 years, with a standard deviation of 14 (range = 21 to 80 years). The group had 11 mean years of education (SD = 3, range = 1 to 18 years). Informed consent was obtained prior to participants' testing.

It is important to note that, while participants denied a history of brain involvement, they were in- and out-patient hospital controls. It is possible that they were under treatment for conditions that may have affected their cognitive performances (hypertension, pain, etc.). In the interests of confidentiality, their diagnoses were not recorded; however, PM & R patients generally present muscular or orthopedic injuries. One line of thinking holds that medical controls more tightly match neurological patients' experiences, minimizing the effects of variables related to hospitalization on outcome

Table 1. Normative Sample

Test	Source	Age	Education
R-WMS (N = 188)	Russell, 1988	M = 48.4 SD = 12.9	M = 12.9 SD = 14.7
SDMT (N = 420)	Smith, 1982	M = 43.8 Range = 18-75	11.9 Range NR
BVRT Admin. A (N = 600) Admin. C (N = 200)	Sivan, 1992	Range = 15-64 NR	NR NR
VFD (N = 20)	Benton et al., 1983	Range = 16-65	NR
PURDUE PEGBOARD Normative sample (N = 26)	Costa et al., 1962	M = 51.9 SD = 16.7	M = 8.53 SD = 2.9
Cross-validation sample (N = 15)		M = 48.33 SD = 14.29	M = 9.6 SD = 3.84
VOT (N = 40)	Boyd, 1981	M = 31.8 SD = 9.52 Range = 19-52	M = 12.4 SD = 1.88
(N = 231)	Mason & Ganzler, 1964	"Adult"	NR
Current Study (N = 71)		M = 49 SD = 14 Range = 21-80	M = 11 SD = 3 Range = 1-18

NR = Not reported.

data. However, the fact that a portion of these normative subjects could be cognitively impaired is a potential weakness of the study. On the other hand, medical controls were a suitable comparison group for the study, as several of the normative samples for the tests were drawn from medical settings (see Table 1).

Procedure and Measures

All participants in this study were given a modified version of the Michigan Neuropsy-

chological Battery (MNB), which is comprised of objective standardized measures of a broad range of language, verbal and nonverbal reasoning, and auditory and visual memory functions, as well as selected somatosensory and manual motor skills.²⁸ The administration time for these tests varied from 3.5 to 4.5 hours. The neuropsychological tests selected for this investigation include Russell's revision of the Wechsler Memory Scale (R-RWMS),²⁹ the Symbol Digit Modalities Test (SDMT),³⁰ the Benton Visual Retention Test (BVRT), Administration

Demographic Data

Gender	Ethnicity	Recruitment/health status
Male = 177 Female = 11	"White" = 176 "Non-White" = 12	Subjects were patients at a Veteran's Administration Medical Center, suspected of having had a neurological condition but having received a negative neurological exam.
NR	"Caucasian" = 420	Subjects were volunteers from Madison Heights, MI and Florence Township, NJ—excluded were individuals with a history of vascular or infectious disease, trauma, or central nervous system pathology.
NR	NR	Subjects were in-patients and out-patients in Iowa City and Des Moines, IA, hospitals, with no history of psychosis, "mental defects", cerebral injury or disease, or serious depletion due to somatic disease.
NR	NR	Subjects were medical patients with no history or evidence of cerebral disease.
NR Male = 10 Female = 16	NR NR	Subjects were "hospital controls." All subjects were referred to neuropsychology laboratory for psychodiagnostic evaluation, or to neurology service; patients admitted to neurology had lesions in the peripheral nervous system or below the level of the thoracic nerve in the spine.
Male = 9 Female = 6	NR	
Male = 24 Female = 16	"White" = 30 "Black" = 10	Subjects were patients at the Los Angeles County University of Southern California Medical Center. Excluded were subjects over 55 years of age, or those with a history or evidence of organic brain disease. Selected were neurotic, affective, and non-neuropsychiatric inpatients. Thirty-seven were right-handed, three were left-handed.
Male = 231 Female = 0	NR	All subjects were patients in a Veteran's Administration hospital.
Male = 28 Female = 43	"African American" (self-identified) = 71	Subjects were in-patients or out-patients in the Physical Medicine and Rehabilitation Service of Howard University Hospital in Washington, DC, who were being treated for injuries that did not involve the brain. Patients denied a history of brain insults, psychiatric illness, alcohol or drug abuse.

A and C,³¹ the Visual Form Discrimination Test (VFD), the multiple choice variant of the BVRT,³² the Purdue Pegboard Test,³³ and Hooper's Visual Organization Test (VOT).³⁴ Table 1 shows demographic variables for the original standardization samples for the tests.

Conventional neuropsychological cutoff scores were used in the investigation. These values appeared in published manuals or published validation studies of these neuropsychological instruments. If a patient was unable to complete the tests in a single administration,

the examiner usually administered the remainder of the battery in a second test session.

Analysis

The level of performance approach (i.e., cutoff scores) for neuropsychological test interpretation was used to determine the percentage of false positive classifications in a sample of African American controls. Heaton et al. recently revisited the issue of diagnostic accuracy of neuropsychological tests,³⁵ stating that "in the diagnostic use of any norms, one

is concerned about accuracy in classifying both normal and abnormal subjects (sensitivity and specificity, respectively). Given the degree of overlap generally seen in the test scores of both normal and brain damaged participants, we have found that the use of a 1-SD cutoff (below a T-score of 40 = 'abnormal') provides the best balance between sensitivity and specificity" (p. 580). These researchers note that, using the most ideal norms, a 1-SD cutoff will result in a false positive rate of 15%, and that the rate can be improved by selecting a more stringent cutoff (such as 2SD) but this would "reduce sensitivity to brain disorders." Heaton et al.²⁸ state that while the pattern of "trade-off" between sensitivity and specificity will differ at different cutoff scores, the best norms will assess demographically different populations at similar levels of accuracy. They identify 15% of a normative sample as a generally acceptable false positive rate for a neuropsychological measure; generally, acceptable false positive rates almost never exceed 20% of normative samples for the tests. In this preliminary report, false positive rates exceeding 20% of a sample are defined as unacceptable, or too high, at relatively less stringent cutoff scores set at 1.5 SD or 2 SD below the mean.

RESULTS

Table 2 shows the misclassification (false positives) rates for normal controls on the neuropsychological measures used in the present investigation, along with the accepted cut-off scores for the tests and, by way of comparison, false positive rates for the normative samples. Table 1 shows demographic variables for the original standardization samples for the tests. On Russell's version of the Wechsler Memory Scale,²⁹ 83% of controls scored in the impaired range on the Immediate Logical Memory task, 71% scored as impaired on the Delayed Logical Memory task, and 45% scored in the impaired range on Logical Memory Percent Retained, even after the scores were corrected for age

and education as per Russell's recommendations. These percentages of false positives were considerably higher than those reported for the normative sample for the test (see Table 2). Misclassification rates for the Visual Reproduction subtest were comparable to those reported for the normative sample (immediate visual reproduction, 27%; delayed visual reproduction, 32%; visual reproduction percent retained, 36%).

The number of controls incorrectly classified as brain impaired on the SDMT (oral and written administrations) was higher than the number so classified in the normative sample (written, 49% misclassified at a cut-off of -1.5 SD < mean; oral, 54% at this cut-off score). In contrast, performances on the BVRT (memory and design copying) were mixed. Using the number error score procedure,³¹ the misclassification rates were much higher than in the normative sample (Administration A (number correct), 33%; Administration A (number of errors), 41%; Administration C (number of errors), 17%). The number of controls incorrectly classified as "defective" was slightly elevated at a cutoff score of 3 using the number correct procedure and within an acceptable range at a less stringent cutoff level of 4. On the Design Copying task, the percentage of false positives is less than 20% of the sample, a generally acceptable level. The percentage of normal controls with VFD test scores in the impaired range was acceptable by the same criterion (5.7% in our sample, compared to 5% in the normative study).

Using Costa et al.'s cutoffs for the Purdue Pegboard task,³³ a high proportion of controls was misclassified (22.53%, left hand; 42.25%, right hand) as compared with the normative sample. Furthermore, when the most stringent VOT cutoff (<25.5 correct) was used, the number of misidentifications was extremely high relative to the number of persons misclassified in the normative sample (58.82%, as compared to 20% in the normative study). At a more liberal criterion level (<20 correct), the percentage of incorrect diagnoses is within a gen-

Table 2. Misclassification Rates (False Positives) of African American Normal Controls and Normative Samples on Selected Tests from the Michigan Neuropsychological Battery

Test	Cut-off score	Misclassified African American normals (%)	Misclassification rates (%) in normative studies
R-WMS (N = 68)			
LOG MEM IMM	>2	83	43
LOG MEM DEL	>2	71	37
LOG MEM % RET	>2	45	24
VIS REPRO IMM	>2	27	30
VIS REPRO DEL	>2	32	28
VIS REPRO % RET	>2	36	38
SDMT (N = 70)			
Written	-1.5 SD<MEAN	49	8
	-2.0 SD<MEAN	36	NR
Oral	-1.5 SD<MEAN	54	8
	-2.0 SD<MEAN	43	NR
BVRT (N = 69)			
Admin. A	3	33	3.90
# Correct	4	11	.56
Admin. A	4	41	14.9
# Errors	5	22	6.0
Admin. C	5	17.0	2
# Errors	6	8.5	0
VFD (N = 69)	<24 #correct	5.700	5
	<23 #correct	.014	0
PURDUE PEG (N = 71)	<11 pegs (LH)	22.53 (LH)	14.63 (Combined LH,RH)
	<13 pegs (RH)	42.25 (RH)	
	<10 (LH,RH) Age 60+		
VOT (N = 68)			
	<25.5 #correct*	58.82	20*
			24**
	<20.0	19.11	0**

R-WMS: Russell's version of the Wechsler Memory Scale.

LOG MEM IMM: Logical Memory Subtest, Immediate Condition.

LOG MEM DEL: Logical Memory Subtest, Delayed Condition.

LOG MEM % RET: Logical Memory Percent Retained.

VIS REPRO IMM: Visual Reproduction Subtest, Immediate Condition.

VIS REPRO DEL: Visual Reproduction Subtest, Delayed Condition.

VIS REPRO % RET: Visual Reproduction Percent Retained.

SDMT: Symbol Digit Modalities Test.

BVRT: Benton Visual Retention Test.

VFD: Visual Form Discrimination Test.

PURDUE PEG: Purdue Pegboard Test LH = Left-handed RH = Right-handed.

VOT: Visual Organization Test.

NR: No norms were reported.

*Boyd, 1981.

**Mason and Ganzler, 1964.

erally accepted range (19.11%).³⁷ Still, the number of controls misidentified as impaired exceeded the number of false positives in the normative sample by a large margin.

DISCUSSION

This pilot investigation examined the predictive accuracy of several tests included in a modified version of the Michigan Neuropsycholog-

ical Battery in a group of non-brain-injured African Americans. While the "hit rates" for these measures of higher and lower level cerebral functions varied considerably, in general, misclassification rates were unacceptably high.

In our sample, revised norms for Russell's version of the Wechsler Memory Scale²⁹ were inadequate for judging the integrity of the underlying semantic and visual memory processes involved in this test. While an exceptionally large number of non-brain-injured controls were misclassified on the Logical Memory subtest, the number of false positives on the Visual Reproduction (VR) subtest is similar to misclassification rates for the normal sample. Clearly, these data indicate that Russell's revised logical memory norms²⁹ are inadequate for populations similar in background to the participants in our study. Elsewhere, we speculated that the incompatibility between the structure and content of the logical memory passages and the existing cognitive schemes used by our controls to process this information contributed to the substantial number of false positives.³⁸ Russell^{29,36} advised that, since the number of ethnic minorities and women included in validity studies was small, caution should be exercised in using such measures with these groups. In light of the present findings, this cautionary note on Russell's revised version of the Wechsler Memory Scale seems well founded.

Although Russell's revised version of the Wechsler Memory Scale has been largely replaced by the Wechsler Memory Scale-Revised (WMS-R), and most recently by the WMS-III, there is evidence that the revised scale has not addressed some of these same problems. For example, recent data from our laboratory on the WMS-R Logical Memory Subtest suggested that, like Russell's revised version of the scale, the WMS-R inaccurately assessed neurological status and was insensitive to laterality of lesion in an African American sample of patients with brain lesions.³⁹ This may have been partly due to the fact that WMS-R scores in this sample strongly correlated with demographic variables

such as age and education.⁴⁰ A validation study on the predictive accuracy of the WMS-R, and of the newer WMS-III, among normal African American controls should also be undertaken.

The SDMT, another measure used in the current study, has been acknowledged as one of the more sensitive measures for screening cerebral dysfunction in children and adults.⁴¹ In the present investigation, an unacceptable number of persons were incorrectly misclassified when SDMT (oral and written) norms were used. Published cutoff scores established for use with the SDMT are presently not suited to assess the organic condition of the brain in populations similar in background to our sample. These findings are especially noteworthy in light of the fact that normative data for the SDMT, as well as the RWMS, are adjusted for the age and education level of the testee.

The BVRT and its multiple choice variant, the Visual Form Discrimination test, were developed to assess the status of visual-perceptual, spatial, constructional and memory functions. When used together, these tests contribute important information related to the status of these cognitive processes in the context of brain damage. Using an error criterion, the misclassification rates for our population were considerably higher than those for the normative sample. In contrast, using the number-correct procedure, the number of controls incorrectly classified as "defective" was slightly elevated at one criterion level (a cutoff of 3) and within an acceptable range at a less stringent level (a cutoff of 4). On the Design Copying subtest of the BVRT and the VFD test, the percentage of false positives was within generally acceptable limits.

While it is commonly believed that the Purdue Pegboard is a test of lower level motor functions and is not as susceptible to sociocultural or demographic factors as measures of higher cortical functions, there is evidence to the contrary. We found that a substantial number of normals earned scores in the impaired range. While it is not clear what factors contribute to the disparities in performance between

patients in Costa et al.'s normative sample³³ and our normal controls, conceivably such factors as time orientation,⁴²⁻⁴⁴ as well as affective and motivational states^{45,46} may have contributed to this disparate outcome. It is interesting to note that our participants, who were right-handed, performed more similarly to the normative sample when tested on the left hand and were more likely to be misclassified when tested using the right hand. While outside the scope of this study, this finding bears further reflection.

The VOT originated as a brief screening instrument to identify persons with "organic" cerebral pathology, and data has been offered in support of this claim.^{34,37,47} Rathburn and Smith,⁴⁸ however, suggest that, as a general indicator of neuropsychological functioning, the VOT is limited. They contend that it possesses greater sensitivity as a measure of specific cognitive defects that are localizable to the right posterior region of the brain. The two most commonly recommended cutoff scores are 20³⁴ and 25.5.³⁷ Still, at the more lenient level of performance, the "hit rate" is significantly lower among our controls in comparison to normal controls participating in other normative studies.^{37,49} Using an African American population, Coyle and Eisenman⁵⁰ found that approximately 25% of their normal controls performed at a level indicative of "mild" neurological impairment. These researchers urged that extreme caution be exercised when using the VOT with other ethnic/cultural groups, since their results were seemingly artifactual and not indicative of true neuropathology. We concur with this recommendation.

These findings hold several implications for neuropsychological research and service delivery with African Americans and other ethnic minority populations. Clearly, misclassification rates for single neuropsychological instruments are too high to make inferences about the organic condition of the brain.⁵¹ There is, however, a general consensus among most experienced clinical neuropsychologists that, in the context of a comprehensive neuropsychologi-

cal test battery, the information that a single instrument contributes to the neuropsychological assessment process can be quite valuable.⁵¹ The use of multiple inferential methods in neuropsychological assessment greatly enhances the accuracy of neuropsychological test interpretation.⁵² Because these multiple inferential approaches may be subject to the influence of demographic and sociocultural factors, however, it is important that the relationship between these approaches to neuropsychological test interpretation and ethnicity/culture be explored.

Numerous researchers have established that human functioning cannot be separated from the cultural and immediate social context in which the behavior develops.^{13,53} Relatedly, Boykin⁵⁴ and Miller-Jones⁵³ have noted that standard psychological test situations are context-specific environments that are culturally informed. These contexts exert influence on both the accessibility, as well as the deployment of cognitive processes in specific test situations.⁵³ Since the development of cognitive processes occurs in culturally organized activities, it seems obvious that these processes should be measured in similar cultural contexts. The failure to structure the measurement of these processes in a meaningful cultural context can lead to an incomplete and distorted view of these processes, as well as misinterpretations of performance data. For example, we elsewhere reported that, when the neuropsychological performances of an African American sample of patients with cardiovascular lesions are compared to neurologically intact groups of Euro-Americans in other studies, the magnitude of the difference is substantially greater than a comparison that involves a normal African American population and their brain-injured counterparts.^{8,38}

A central premise in our work is that the most appropriate context for interpreting neuropsychological test performance of African Americans is in terms of African American normative behavior. The race-homogenous paradigm, as this approach is known, controls for

culturally-linked variations in neuropsychological test performance. However, we acknowledge that, even when race or ethnicity are held constant, the level of acculturation may still influence neuropsychological processes within African Americans.¹⁶ A race homogeneous paradigm may be an improvement, but still assumes that African Americans are a monolithic group. In fact, social, demographic and acculturative factors provide a distinct basis of differentiation which conditions the lives of African Americans.^{15,16} Ideally, clinicians should have tools that are sensitive to ethnicity, cultural variation, age, education, gender, regional variation in behavior, primary language, urban versus rural setting, and influences that occur when testor and testee are mismatched on the above factors. One way to construct this “clinical guidebook” will be to continue to encourage research on neuropsychological performance with diverse participants as subjects.

Historically, researchers and clinicians ignored the effect of demographic factors on neuropsychological test performance. Previously, it was commonly believed that the amount of variance in neuropsychological test performance that these factors accounted for was minuscule. Now researchers have noted that, in addition to age, gender and education, socioeconomic status (SES) may also be a source of the variance in neuropsychological test performance, and have urged greater research attention to this issue.⁵⁵ Certainly this factor needs to be explored in more detail in neuropsychological studies. Inasmuch as demographic factors impact on neuropsychological test performances, there is a critical need to develop demographically sensitive norms for these measures.⁵⁵ Hale-Benson⁵⁶ has noted that conventional ways of measuring SES may not be relevant for African Americans. In the African American community, where the extended family network system figures prominently in the socialization of the family members, it may be useful to examine the occupation, income, and values of several generations to fully understand the social network in which an indi-

vidual is reared. This observation further underscores the need to factor culture into the equation.

We have highlighted the more salient issues that impact on neuropsychological research and service delivery with African Americans. Foremost among the issues that we have reviewed is the tendency of neuropsychological tests to over-diagnose organic impairment in our group of non-brain-injured African Americans. This is a major concern. These preliminary data clearly illustrate the limited utility of these neuropsychological measures with groups similar in sociocultural background to our controls, and they illustrate the critical need to develop normative data for African Americans and other ethnic minority populations. Given the current limited ability of our neuropsychological measures to correctly identify non-brain-injured controls, there is a need to establish new cutoffs for conventional neuropsychological tests that are based on the normative performances of African Americans, or in some other way control for level of acculturation within this group.

In summary, from our perspective, there is a critical need for neuropsychologists to develop theoretical formulations and research paradigms that fully accommodate the cultural context of the groups being studied.⁵⁷ Indeed, we need a discipline whose assumptions, concepts, methods and theories are more pluralistic and inclusive of culturally diverse viewpoints. Of course, this would entail the fundamental re-examination of basic assumptions, concepts, methods and theories in neuropsychology from a variety of cultural contexts. The approach advocated here, in contrast to other existing approaches, provides a sociocultural framework within which principles of human brain-behavior functions can be fully described and examined. Overall, the heuristic value of this approach and the potential it offers in terms of clarifying and broadening our understanding of neuropsychological functioning in humans, far outweighs its limitations.

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