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Texas Mexican American Adult Normative Studies: Normative data for the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS)

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Abstract

The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) is an assessment of neuropsychological functioning commonly used in clinical and research settings. To our knowledge, normative data for the RBANS is not available for Hispanic, Mexican Americans, which the current study sought to establish. Data from 136 Hispanic, Mexican Americans from Project FRONTIER were analyzed. Approximately half of the sample was administered testing in Spanish. Normative tables were created for English and Spanish speaking Mexican Americans. Generated RBANS normative references are provided for unadjusted raw scores as well as output adjusted by education level.

Keywords

RBANS; normative performance; aging; Mexican American; Spanish-speaking

Introduction

The rapidly changing ethnic composition of the United States population highlights the increasing need for normative references for Hispanic individuals. Recent Census estimates show that Hispanics are the largest minority group, reflecting approximately 50% of the population growth from 2000 – 2010; over 65% of the U.S. Hispanic population are Mexican American (U.S. Census Bureau, 2010). Royall, Espino, Polk, Palmer and Markides (2004) suggested that, obtaining normative data for diverse groups is essential, as relying on non-matching reference norms based on contrasting ages or ethnicities makes it more likely that interpretative errors will be committed. Past research has shown that ethnicity based norms improve sensitivity and specificity in detecting cognitive impairment (Ardila, 1995; Lucas et al., 2005; Manly, 2005).

Increased efforts have been made in recent years to focus on factors related to cognitive aging among Mexican Americans (Edwards, Hall, Williams, Johnson & O'Bryant, 2015; O'Bryant et al., 2013). This body of work has shown that Mexican Americans develop

cognitive dysfunction at younger ages; however, despite a propensity for younger onset of cognitive decline, diagnoses of a neurodegenerative disease is often obtain in later stages of the disease process (O'Bryant et al., 2013). The latency of diagnosis is often attributable to several factors including limitations in access to health care and more salient is low presentation rates to specialty care clinics (Mejia, Gutierrez, Villa, & Ostrosky-Solis, 2004; O'Bryant, Humphreys, Schiffer & Sutker, 2007). Further contributing to rates of misdiagnosis includes low specificity of cognitive screening measures among Hispanic populations, which are commonly utilized within primary care settings. Work has shown that demographic factors such as level of education can play a significant role in the limitations posed by one global cognitive screener, the Mini Mental Status Examination (MMSE) specifically among Spanish speaking elders (Mejia, Gutierrez, Villa, & Ostrosky-Solis, 2004; Rosselli, Tappen, Williams, & Salvatierra, 2006).

Mexican Americans have also been shown to be differentially impacted by established genetic risk factors for cognitive loss including that of the ApoE e4 genotype, which is often attributed as being the strongest genetic risk for late-onset Alzheimer's disease (AD) (O'Bryant et al., 2013). Additionally, in contrast to other ethnic groups, Mexican Americans further pose increased risk for development of neurodegenerative diseases secondary to modifiable risk factors including medical as well as psychiatric conditions (O'Bryant et al., 2013). Recent efforts have shown that not only do Mexican Americans experience higher rates of comorbid depression and diabetes as compared to their non-Hispanic white counterparts but that the comorbidity itself poses a strong risk for cognitive loss and impairment (Johnson et al., 2015).

Growing research centered around cultural neuropsychology has focused on ethical concerns of misapplication of normative data. Most of the work points out limitations and risk for misdiagnosis in diverse populations in the application of reference data established within predominantly well-educated Caucasian samples. Related to this, several commonly utilized neuropsychological tests have sought to establish ethnic-specific normative references including the Rey Auditory Verbal Learning Test (RAVLT, Lucus et al., 2005), Brief Visuospatial Memory Test-revised and Hopkins Verbal Learning Test-revised (BVMT, HVL, Cherner et al., 2007), and Wechsler Memory Scale (WMS, Lucus et al., 2005). Further work has specifically focused on generating Mexican American normative references for measures including the Boston Naming Test (Jahn et al., 2013) as well as for the Clock Drawing Test (Menon, Hall, Hobson, Johnson & O'Bryant, 2012).

A test that has been widely used in the assessment of cognitive functioning is the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) (Randolph, 1998). Several studies have supported the psychometric properties of the RBANS, with past research reporting acceptable test-retest reliability, internal consistency, and concurrent validity (Gold, Queern, Iannone, & Buchanan, 1999; Hobart, Goldberg, Bartko, & Gold, 1999; Larson, Kirschner, Bode, Heinemann, & Goodman, 2005). The RBANS has been found to be a valid measure of the cognitive decline associated with various neurological conditions including stroke (Larson et al., 2003; Larson et al., 2003), Alzheimer's disease (Randolph, Tierney, Mohr, & Chase, 1998; Duff et al., 2008), multiple sclerosis (Beatty,

2004), Parkinson's disease (Beatty et al., 2003) and Huntington's disease (Randolph et al., 1998).

The RBANS has been used in studies spanning various populations including Russian-Americans (Buvshstein, 2004), Australians (Green et al., 2008), African-Americans (Patton et al., 2003) as well as for Spanish speakers in Spain (De la Torre et al., 2014). Several of the studies conducted in Spain have shown utility of the RBANS as a screening tool for specific populations including Schizophrenia and non-psychotic disorders (De la Torre et al., 2016; Sanz et al., 2009) as there were notable differences in scores relative to healthy community dwelling participants. Further evaluation of a monolingual Spanish speaking sample also within a forensic psychiatric inpatient setting identified the average obtained RBANS Total Index score as being impaired, which was consistent with other studies examining its utility within psychiatric populations (Aguilar Karyadi, Kinney, & Nitch, 2017; Bailie et al., 2012; Iverson et al, 2009). This study further found one standard deviation difference in average RBANS scores obtained by Spanish speakers as compared to their English-speaking counterparts (Aguilar Karyadi, Kinney, & Nitch, 2017).

To our knowledge, no prior work has provided normative references for English- or Spanish-speaking Mexican-Americans, despite the fact that it has been utilized in clinical and research settings (Sanz, Vargas, & Marín, 2009). As part of the Texas Mexican American Adult Normative Studies (TMAANS), here we provide normative data for the RBANS for a sample of English- and Spanish-speaking Mexican Americans.

Materials and Methods

Data were analyzed from a sample of 136 English- and Spanish-speaking Mexican-Americans (107 females, 29 males) recruited as part of Project FRONTIER (Facing Rural Obstacles to healthcare Now Through Intervention, Education and Research), a previously conducted epidemiological study of health among rural-dwelling individuals. Race and ethnicity were classified via self-report according to US Census and primary language (English or Spanish) was assessed via a self-report questions. Approximately half of the Mexican-American sample chose to be tested in Spanish ($n = 67$) rather than English ($n = 69$). All participants were assessed via form A of the RBANS with both the English and Spanish versions being acquired from the publisher. All other participants reported adequate mastery of English and were tested in that language. Education was self-reported for the highest level completed. For the sample, education level was 8.23 ± 3.97 (range = 0–18) and age was 53.61 ± 8.89 (range = 40–79).

The Project Frontier methodology has been discussed in detail elsewhere (O'Bryant et al., 2011) Briefly the protocol includes a standardized medical examination, clinical labs, neuropsychological testing including the MMSE, Clinical Dementia Rating (CDR) scale and the RBANS as well as interviews with participants and informants. Inclusion criteria were (1) age 40 and above and (2) residing in one of the counties part of Project FRONTIER, including Cochran County and Parmer County, both located on the Texas – New Mexico border. Participant recruitment was conducted by community recruiters through brochures/flyers, presentations and events, as well as in-person and/or door-to-door solicitation. Project

FRONTIER was conducted under an Institutional Review Board approved protocol with each participant providing signed informed consent.

All data was reviewed by a consensus panel composed of a clinical neuropsychologist and physicians who reviewed all information from neurocognitive tests and clinical interviews. Diagnosis of AD dementia was based on NINCDS-ADRDA criteria (McKhann et al., 1984) while Mild Cognitive Impairment (MCI) was assigned according to the Petersen criteria (Petersen, 2003). In order to ensure a well-defined “normal” sample, individuals were excluded if they exhibited global cognitive impairments defined as an MMSE score ≤ 20 , and a Clinical Dementia Rating (CDR) Global Score ≥ 0 . Only participants who were judged to be cognitively “normal” were included in the analyses. The current study used the Statistical Package for the Social Sciences Software (SPSS), version 16.0, and significance was set at $p = 0.05$.

Measures

The RBANS (Randolph, 1998) is a brief, individually administered screening test battery composed of 12 subtests measuring visuospatial/constructional abilities, attention, language, immediate and delayed memory, further generating five Index scores and a Total Scale score. All subtests were administered per manualized procedures.

Results

Stepwise regression analyses were conducted with age, language of test administration, education, and gender entered as predictor variables and RBANS subtests entered as dependent variables. Where the predictor variables accounted for a significant portion of the total variance, adjustments were made for the affected tests. In order to avoid dilution of the sample size into smaller subgroups, stratification was only conducted for demographic factors that accounted for 10% or more of the variance. This was done for the following reasons: (1) the clinical impact of a demographic factor with less variance accounted for is likely small and (2) we wanted to avoid normative samples with even smaller cell sizes per group. Test language was significant only for Digit Span ($B[SE] = -2.03[0.36]$, $t\text{-score} = -5.61$, $p < 0.01$), while education was significantly related to scores on Coding ($B[SE] = 2.62[0.21]$, $t\text{-score} = 12.10$, $p < 0.01$), Line Orientation ($B[SE] = 0.20[0.07]$, $t\text{-score} = 2.84$, $p = 0.01$), List Recall ($B[SE] = 0.14[0.05]$, $t\text{-score} = 2.83$, $p = 0.01$), Picture Naming ($B[SE] = 0.12[0.02]$, $t\text{-score} = 4.96$, $p < 0.01$) and Semantic Fluency ($B[SE] = 0.41[0.08]$, $t\text{-score} = 5.04$, $p < 0.01$) (Table 2). Age did not account for $>10\%$ of variance in test scores. All other tests were not adjusted. Table 3 presents the unadjusted norms for the RBANS subtests. Since education was a significant factor for a number of the tests, the adjusted norms by education level are presented in Table 4. The Digit Span subtest was affected by language of administration therefore separate norms based on language of administration are shown in Table 5. After the primary stratification variables were identified, the Mayo method (Ivnik et al., 1992) was utilized and mid-point ranges were employed with overlapping subsamples from each stratification. The non-stratified norms for the 5 index scores (Immediate Memory, Visuospatial/Constructional, Language, Attention and Delayed Memory) along with Total Score are presented in Table 6.

Discussion

The purpose of the present study was to create for the RBANS norms for a sample of Spanish and English speaking Mexican-Americans. The use of separate norms for ethnicity is not without criticism and others have noted caution must be used in interpreting findings based on reference group norms. For example, Manly and Echemendia (2007) argue that the use of reference group norms versus existing U.S. population norms depends on the specific question being answered. If the clinician is interested in understanding how an individual performs compared to the majority of the American population, the use of U.S. population norms may be most appropriate. However, if the question is whether the particular score “reflects clinically significant impairments in performance,” then the use of reference group norms that most closely match the individual are appropriate.

As has been shown in previous research (O’Bryant et al., 2013), education has a significant impact on the performance on many of the measures and needs to be taken into account when developing norms for Mexican-Americans. One limitation of this study was that location where education was obtained was unknown. The norms presented in this study are based on a relatively small sample, which is an additional limitation and therefore utilization of the data should be applied with caution. To best address the relative sample size, effort was taken to create a well-characterized sample of cognitively normal Mexican-Americans. Age did not account for >10% of the variance in test scores with education entered into the model and therefore norms were not stratified by this variable. However, the current norms should be validated in an independent sample to determine if additional demographic characteristics need to be taken into account for normative purposes. Given the non-linear impact of education on neuropsychological test performance, and the relatively low level of academic achievement of this population, it is possible that the current norms are biased to reflect this educational impact. Additional methods for detecting the impact of demographic factors on test scores should be examined when a larger sample size is available. Additional work should also be conducted to examine the stability of the normative reference ranges over time with removal of those who decline. Additional work should be undertaken in order to have a larger sample size that enables for education and age stratification. Although well-characterized the sample is drawn from a rural population and may be less representative of a more urbanized and more acculturated population as level of acculturation has been shown to impact performance on neuropsychological tests (Arnold, Montgomery, Castañeda, & Longoria, 1994). As such, caution should be used when applying these norms to individuals dissimilar to the FRONTIER sample. Further development of Mexican-American norms for the RBANS will require gathering data from a larger and more geographically representative sample. Nonetheless, the norms presented here, represent an initial step in providing normative references for English- and Spanish-speaking Mexican-Americans on the RBANS, which may be useful for both researchers and clinicians.

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Table 1

Demographic characteristics of the FRONTIER Sample

Descriptors (N= 136)	<i>M or %</i>	<i>SD</i>	<i>Range</i>
Age	53.61	8.89	40–79
Education	8.23	3.97	0–18
% Female	79%		
% Spanish-speaker	49%		

Table 2

Significant Demographic Variables by RBANS subtest

RBANS subtest	B(Std Error)	t-score	p-value	R ²
Coding	Education 2.62(0.21)	12.10	<0.01	0.53
Digit Span	Test Language -2.03(0.36)	-5.61	<0.01	0.19
Figure Copy	Age -0.08(0.03)	-2.39	=0.02	0.04
Figure Recall	Age -0.12(0.03)	-3.63	<0.01	0.09
List Learning	Age -0.12(0.04)	-2.77	0.01	0.05
Line Orientation	Education 0.20(0.07)	2.84	0.01	0.06
List Recall	Education 0.14(0.05)	2.83	0.01	0.06
Picture Naming	Education 0.12(0.02)	4.96	<0.01	0.15
Semantic Fluency	Education 0.41(0.08)	5.04	<0.01	0.16
Story Memory	Test Language 1.37(0.66)	2.09	0.04	0.03
Story Recall	Age -0.06(0.02)	-2.81	0.01	0.05

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Table 3

Normative Table for all Un-adjusted subtests

Scale Score	Figure Copy	Figure Recall	List Learning (Trials 1–5)	Line Orientation	List Recognition	List Recall	Story Memory	Story Recall
1		0	<16					
2	0	1	16	0	<12	0	<6	0
3	1–4	2	17	7	14–15	1	6	1–3
4	5–7	3	18–19	8	16	2	7	4
5	8	4	20	9		3	8–9	5
6	9	5	21–22	10	17		10	
7	10	6	23	11–12	18	4	11–12	6
8	11–12	7	24	13		5	13	7
9	13	8	25–26	14	19–20	6	14–15	8
10	14	9–10	27–28	15		7	16	9
11	15	11	29	16		8	17	>9
12	16	12	30	17		>8	18	
13	17	13	31–32	18			19	
14	18	14	33	19			20	
15	19–20	15	>33	20			>20	
16		>15						

Table 4

Normative Table Adjusted for Education

Scale Score	Edu = 0-6 N=54				Edu = 7-11 N=45				Edu = 12+ N=36			
	Coding	Picture Naming	Semantic Fluency	Coding	Picture Naming	Semantic Fluency	Coding	Picture Naming	Semantic Fluency	Coding	Picture Naming	Semantic Fluency
1												
2												
3	<6	0	0-8	<13	0		<24	0				
4	6	1-5	9	13-29	1-7	<12	24	1-7				
5	7-9	6	10	30	8	12	25-32					<15
6	10-16	7	11	31-33		13	33-37					15
7	17-18		12	34-36		14-15	38-39					16
8	19-22		13	37-39		16	40-44	8				17
9	23	8	14-15	40-41		17	45-48					18
10	24-28	>8	16	42-44	>8	18-19	49-51	>8				19
11	29-32		17	45-46		20	52-53					20-21
12	33-36		18	47-52		21	54-57					22
13	37-43		19	53		22	58-59					23
14	>43		>19	>53		>22	>59					>23

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Table 5

Normative Table Adjusted for Digit Span

Scale Score	English Speaker Digit Span N=69	Spanish Speaker Digit Span N=67
1		
2		
3		
4		
5	<6	<4
6	6	4
7		5
8	7	
9		6
10	8	7
11	9	8
12	10	9
13	>10	>9

Table 6

Total Scale Index Scores

Index Score	IM	VC	Lang	Attn	DM	Total Score	Percentile Rank
<65		3	9	9	15	74	1
65	8	4-8	10-12	10	16-22	75	1
70	9-10	9-12	13	11	23	82-86	2
71	11		14			87	3
73	12			12	24	88-90	4
75		13			25	91-93	5
77	13				26	94-95	6
78			15	13	27-28	96	7
79					29	97	8
80		14				98	9
81						99	10
82					30		12
83	14			14		100	13
84		15	16			101	14
85	15			15	31	102	16
86				16		103	18
87						104-105	19
88		16	17		32	106	21
89					33		23
90	16			17		107	25
91		17			34		27
92	17					108-109	30
93			18	18			32
94		18			35	110-112	34
95						113-114	37
96	18			19		115	40
99			19			118-119	47
104				21		124	61

Index Score	IM	VC	Lang	Attn	DM	Total Score	Percentile Rank
105		22			39	125	63
106	22					126	66
107				22	40		68
108		23	21			127–128	70
109	23					129	73
110					41	130	75
111						131	77
112	24	24			42	132	79
113			22	23		133	81
115	25	25			43		84
116				24			86
118			23			134	88
119	26	26	24		44	135–137	90
120	27						91
122				25		138	93
123	28	27					94
124						139	95
126				26	45	140–141	96
128		28		27			97
130	29	29			46	142–144	98
134	30				47	145	99
137					48	146	99

Note: IM= Immediate memory; VC= Visuospatial/Constructional; Lang= Language; Attn= Attention; DM= Delayed Memory.