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Performance of Spanish-speaking community-dwelling elders in the United States on the Uniform Data Set

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Abstract

Background—Spanish is the second-most common language spoken in the United States, and Spanish speakers represent one third of the aging population. The National Alzheimer's Coordinating Center's Uniform Data Set implemented a Spanish neuropsychological battery. Previous work described the neuropsychological performance for English speakers. Here we describe performance on the Spanish version.

Methods—Data from 276 Spanish speakers with normal cognition were summarized, with descriptive tables of performance on individual cognitive tests. Regression techniques were used to evaluate the effect of demographics on cognitive performance.

Results—Spanish speakers were younger (70.0 vs 74.0 years) and less educated (10.7 vs 15.7 years) with more females (76% vs 63% female) than the previously described English speakers. Higher education and lower age were associated with better performance.

Conclusion—This national cohort of well-characterized Spanish-speaking elders provides descriptive data on cognitive performance, an important tool for clinical and research efforts.

Keywords

Spanish speakers; Neuropsychological test; Normative performance; Elderly; Alzheimer's

1. Introduction

The Hispanic population in the United States, most of who are primarily Spanish speakers, is one of the nation's fastest growing and largest ethnic minority groups. Spanish is the second-most common language spoken in the United States, with a prevalence of 12% of the total population and approximately one third of the aging population [1]. Spanish is the primary language spoken at home for more than 37.5 million people, of who almost half are limited in their English proficiency [2]. These individuals are at least as likely to experience

cognitive loss and dementia as the broader population. Some have reported higher rates of dementia in the Hispanic population [3,4]. This poses a particular challenge because the assessment of cognitive deficits requires normative data against which to compare performance, and there are little available, particularly for the aging Spanish-speaking population. The recruitment of cognitively healthy Spanish speakers to the Alzheimer Disease Centers (ADCs) around the United States provides an opportunity to collect important data against which to compare performance of those with cognitive complaints. These centers contribute data to the National Alzheimer's Coordinating Center (NACC) using the instruments in the Uniform Data Set (UDS), which consists of a standardized clinical and neuropsychological assessment [5].

The UDS was selected by a clinical task force convened by the National Institute of Aging. The purpose of the UDS neuropsychological battery is to assess the continuum of aging in cognitively normal controls, from mild cognitive impairment (MCI) to early stages of Alzheimer's disease (AD) [5], and consists of brief measures of attention, processing speed, executive function, episodic memory, and language [5]. The value of neuropsychological testing for diagnosis of dementia in the elderly has been well established. The UDS neuropsychological battery was implemented in 2005 at all ADCs throughout the United States, and NACC reports data on approximately 25,556 cases, primarily of English speakers [6]. The neuropsychological assessment, collected from cognitively normal English speakers, has been described [7]. In 2007 the Spanish translation of the UDS was implemented [8] to those with cognitive impairment and to normal controls. This report presents the first description of the UDS performance on a Spanish-speaking normal cohort.

2. Methods

2.1. Data source and recruitment

This sample is selected from data submitted to NACC between 2007 and 2012, with a data extraction date of March 2012. Data included UDS clinical and demographic outcomes as assessed by ADC clinicians and research. Diagnosis was recorded on the UDS form D1 "Clinician Diagnosis—Cognitive Status and Dementia," which was completed by a single clinician or by a consensus diagnosis at each site [5,7].

Data came from 17 ADC sites with bilingual staff and Spanish-speaking elders in their cohort. Staff were expected to follow a structured protocol for administration and were supervised by senior investigators at each site who provided training as needed. Informed consent was obtained in accordance with local institutional review board standards. According to referral information within the UDS database, participants were from a community based convenience sample, recruited by media solicitation or were referred by a clinician, family member or friend. [7].

2.2. Selection of sample

The sample selection met the following criteria: neuropsychological battery administered in Spanish, clinical diagnosis of normal cognition, and a Clinical Dementia Rating (CDR) of 0 [9,10]. All data were collected from the initial baseline visit. Although each site establishes

their own entry criteria, “normal controls” from the UDS data are generally free of major psychiatric illness and variables that are known to affect cognition, such as neurodegenerative diseases, head injury, and strokes.

2.3. Neuropsychological battery

The UDS neuropsychological battery was originally constructed to cover the most common domains in aging and dementia. It was constructed using brief tests or a subtest from formal neuropsychological tests [5]. The Spanish version was translated in consensus by the Spanish Translation and Adaptation Work Group (STWAG), became available online in April 2007 [8], and can be found online at the NACC website [11]. It consists of the following measures.

2.3.1. Orientation and cognitive screens—The Mini-Mental State Examination [10] is a 30-item-based examination used to assess orientation, attention, registration, recall, and language.

2.3.2. Verbal episodic memory—Logical Memory Immediate and Logical Memory Delayed [12] is a task in which participants are read a short story and then asked to recall the information (immediate recall). After 20 minutes, the participant is asked to recall the story (delayed recall).

2.3.3. Attention—Digit Span Forward and Backward [13] is a measure of auditory attention and working memory. The Trail Making Test Part A [12] assesses psychomotor and visuospatial tracking speed.

2.3.4. Semantic memory and language—Category Fluency [14] is a timed task that assesses the ability to produce words belonging to a specific semantic category (animals and vegetables). The Boston Naming Test [15], a 30-item Spanish version of the Boston Naming Test as selected and translated by STWAG [8], is a test of visual confrontation naming to assess word-finding ability. Psychomotor Speed and Visuospatial Function: Digit Symbol [12] is a timed task that assesses visual attention, scanning, coding, and graphomotor speed.

2.3.5. Executive function—Trail Making Test Part B [16] assesses cognitive flexibility and requires the participant to alternate between numbers and letters in sequence.

2.4. Statistical analysis

Descriptive analyses of demographics and neuropsychological data in Spanish speakers with normal cognition were conducted. Tabular summaries and regression methods are presented in the neuropsychological data from subjects with normal cognition. The covariates of interest in these analyses were sex, age, and education.

Regression analysis of the neuropsychological scores were conducted first using a univariate model adjusted for sex, age, and education separately and then using a multivariate model adjusted for sex, age, and education together. For the delayed recall score (Logical Memory A Delayed), the above analyses were also adjusted for the time interval (Logical Memory A Delayed length of time delay). The Trail Making scores (Parts A and B) were log-

transformed before applying the above regression analysis. All summaries were performed using SAS 9.2.

2.4.1. Classification for age and education data tables—Cases were subdivided into three age ranges (<69, 70–79, and ≥80 years) and two education levels (<12 and ≥12 years). Means and standard deviation were calculated for data in each age and education cell.

3. Results

Demographics of the participants are summarized in Table 1. 99 % of the study population identified themselves as being from Hispanic or Latino ethnicity. Sixty-four percent of the participants completed less than 12 years of education. Table 2 presents a summary of statistics for each neuropsychological test, including the mean, standard deviation, median, 25th and 75th quartiles, and range.

Table 3 provides the results of the univariate and multivariate linear regression models. The standard output of these models includes estimates of coefficients and their 95% confidence intervals. Statistically significant estimates ($P < .01$) are noted in bold.

Higher education was associated with better performance on most tests. Older age was associated with poorer performance on delayed recall, category fluency (animals), and Trail Making Test Part B. Finally, female sex was only associated with better performance on the Boston Naming Test. Finally, sex was only associated in the Boston Naming Test with female gender associated with better performance. Table 4 presents the means and standard deviations by age and education.

4. Discussion

This work describes the initial cognitive data from clinically normal Spanish speakers participating in this multicenter research study. We note that this Spanish-speaking cohort is younger than the previously described English-speaking cohort (70 vs 74.0 years) and less educated (10.7 vs 15.7 years) with more females (76% vs 63 % female) [7]. The trends in sex and education have been noted in other cohorts of Spanish speakers in the United States [17–20]. Similar to previous reports, our sample demonstrates better performance in the younger group and the higher educated group [18]. Education has a beneficial effect even in those older than 80 years, although the sample is quite small.

Given the breadth of recruitment methodologies, each associated with a tertiary medical center, the participants are not likely to be representative of the general population. However, they compose the demographic characteristics of the Spanish-speaking elders participating as normal controls in dementia research in the United States. Further, the cohort has been cognitively characterized and determined to be free of dementia by expert clinicians. Although a separate cognitive battery was not used for diagnosis, clinical judgment by expert physicians provides an independent method of diagnostic classification. The UDS neuropsychological battery uses well-established tests assessing the domains most

often affected in cognitive diseases of aging, and these results extend the ability to interpret the results in Spanish-speaking elders.

Spanish speakers have been shown to perform lower on certain tests of cognitive functioning [18,22,23]. In this current study, we note that all mean scores were lower in this cohort when compared with the larger, mostly nonminority cohort [7]. However, there are other reasons that might account for this difference in performance, including country of origin, time in the United States, and education level. The population of elders tested in Spanish who are participating in the UDS varied in country of origin, but it was predominately from Mexico, Cuba, and South America. The extent to which our results can be generalized to Spanish speakers from each country/region of origin will need to be determined in future studies with larger samples of each regional group. Previous literature suggests variables such as literacy in Spanish, length of time in the United States, and proficiency of English as important to consider when assessing Spanish speakers in the United States [21]. The UDS database does not collect such variables; therefore, we cannot report on effect on performance. However, others have described such a difference in performance on neuropsychological measures between English and Spanish Speakers in the United States [15,23,24]. Future research may wish to examine the basis for differences in performances across these groups.

Factors such as age, sex, and education affect some scores, and the pattern of association of scores with demographic features is similar between this cohort and other cohorts. For example, males and females differ significantly in the Boston Naming Test. This association was also observed among English speakers [7], with better performance of males than females, which is a result that has been described by others [22]. It is interesting to note that few test scores were affected by age, and they included verbal episodic memory (delayed recall), Category Fluency: vegetables, and Wechsler Adult Intelligence Scale (WAIS)-IV Digit Symbol. We expected that a greater number of tests in the UDS battery would yield a significant effect of age, such that the scores of older adults would be worse than the scores of younger adults, as previously observed in studies of English-speaking participants [7]. The inability to see this effect may be due to the smaller sample of Spanish speakers.

Consistent with previous literature, education played a significant role affecting all test scores. The mediating effect of education found in English and Spanish speakers on neuropsychological measures has been reported [17,23,25]. This is important to point out because 64% of the cohort had completed less than 12 years of education. However, this is representative of the current population participating in the UDS. It is essential for clinicians and researchers to understand that education is an important factor in determining performance, even in the relatively younger cohort. In addition, cultural biases may affect performance. Ardila has described at least eight culture-dependent factors that can affect performance, including the definition of “authority,” “best performance,” and “speed” as well as demographic “distance” between examiner and examinee [26]. When clinicians evaluate cognitive performance, they need to consider that low education and these cultural factors may be responsible for poor performance rather than disease.

Although the size of our sample of Spanish speakers is relatively small, future research may permit us to determine if this description of performance will discriminate between those with and without dementia. Of interest will be the specific ability to detect mild deficits such as those seen in MCI and to determine if these mild deficits predict the progression to dementia observed in English-speaking cohorts. It will also be important to see if this data set allows us to identify those with biomarker evidence of AD. These results may be most useful for clinicians' evaluation of Spanish-speaking participants with cognitive complaint because, to date, cognitive impairment is the most sensitive and economic predictor of impending dementia.

These results describe neuropsychological data on Spanish-speaking elders with a wide range of educational levels. The data reported here, collected from 275 elders, represent an attempt to standardize. This data set represents the largest compilation of the UDS data on cognitively normal Spanish speakers. Although a larger sample with a more representative recruitment strategy would provide greater confidence to establish a normative performance sample, these initial descriptive data and this analysis represent an important tool for assessing cognition in Spanish-speaking elders. Given that its development was harmonized with the English version, it offers the opportunity to make reference to a very large body of data to unravel cognitive function in aging.

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RESEARCH IN CONTEXT

1. Systematic review: There is limited experience with the neuropsychological assessment of aging Spanish speakers in the United States. Although some tests have normative data, the cohorts often are minimally characterized, leaving a large gap in knowledge for the assessment of cognitive loss and dementia.
2. Interpretation: Here we present the performance on the neuropsychological battery of the UDS from well-characterized Spanish Speakers deemed not cognitively impaired by expert clinical evaluation. They are notably younger and less educated than English-speaking elders recruited at the same sites. However, demographic features have the same effect on cognitive performance in both groups. Performance on each cognitive measure is described by age and education strata, providing a measure against which to compare others of a similar demographic.
3. Future directions: Future directions may include collection of a larger sample to establish robust normative data and longitudinal assessment to determine how these functions change over time.

Table 1

Demographic features of elders tested in Spanish, stratified by education ranges (N = 276)

Demographics	N (%)	Mean (SD)
Age, years		70.6 (8.7)
69	122 (44.2%)	
70 to 79	113 (40.9%)	
80	41 (14.9%)	
Education, years	275	10.7 (5.0)
8	96 (34.8%)	
>8 to 12	82 (29.7%)	
>12	98 (35.5%)	
Gender		
Female	211 (76.5%)	
Origins		
Mexican	66 (23.9%)	
Puerto Rican	44 (15.9%)	
Cuban	57 (20.7%)	
Dominican	25 (9.1%)	
Central American	16 (5.8%)	
South American	54 (19.6%)	
Other	5 (1.8%)	
Unknown	9 (3.3%)	

Table 2

Summary statistics for UDS test scores in cognitively normal Spanish elders

Variable	<i>n</i>	Mean (SD)	Q ₂₅	Median	Q ₇₅	Range
MMSE: orientation	273	9.3 (1)	9	10	10	(5,10)
MMSE total score	273	27.9 (2.3)	27	29	29	(17,30)
Logical Memory Immediate	232	11 (3.8)	9	11	13.5	(0,21)
Logical Memory Delayed	232	9.3 (4.1)	6	9	12	(0,19)
Digit Span-Forward total trials	252	5.9 (2.1)	5	6	7	(0,12)
Digit Span-Forward longest sequence	252	5.4 (12)	5	5	6	(0,8)
Digit Span-Backward total trials	252	4.7 (1.8)	3	5	6	(0,11)
Digit Span-Backward longest sequence	252	3.7 (1.1)	3	4	4	(0,7)
Category Fluency: animals	265	16.6 (4.6)	13	17	20	(5,31)
Category Fluency: vegetables	256	11.6 (3.3)	9	11	14	(3,21)
Trail Making Part A, time in seconds	259	53.4 (29)	33	44	66	(15,150)
Trail Making Part B, time in seconds	246	155.7 (79.7)	89	130	215	(40,300)
WAIS Digit Symbol total items in 90s	260	31.5 (12.9)	23	30	40	(2,64)
Boston Naming Test total score	252	23.3 (4.2)	21	24	26	(9,30)

Abbreviations: UDS, Uniform Data Set; MMSE, Mini-Mental State Examination; WAIS, Wechsler Adult Intelligence Scale.

NOTE. *n* indicates the number of subjects with data. Range includes minimum and maximum score. Q₂₅ indicates the 25th percentile, and Q₇₅ indicates the 75th percentile.

Table 3

Univariate and multivariate regression analysis with 95% confidence intervals of the regression coefficients

	Univariate model			Multivariate model		
	Sex	Age	Education	Sex	Age	Education
MMSE: orientation	−0.04 (−0.32, 0.24)	0.01 (−0.01, 0.02)	0.06 (0.03, 0.08)	−0.04 (−0.31, 0.23)	0.01 (0.00, 0.02)	0.06 (0.03, 0.08)
MMSE total Score	0.00 (−0.63, 0.63)	0.00 (−0.03, 0.03)	0.17 (0.12, 0.22)	0.05 (−0.54, 0.63)	0.01 (−0.02, 0.03)	0.17 (0.12, 0.22)
Logical Memory Immediate	−0.41 (−1.59, 0.76)	−0.04 (−0.10, 0.01)	0.23 (0.14, 0.33)	−0.36 (−1.47, 0.75)	−0.04 (−0.09, 0.02)	0.23 (0.14, 0.33)
Logical Memory Delayed Recall [*]	−0.37 (−1.64, 0.89)	−0.09 (−0.15, −0.03)	0.25 (0.15, 0.35)	−0.28 (−1.46, 0.90)	−0.08 (−0.13, −0.02)	0.25 (0.15, 0.35)
Digit Span-Forward total trials	0.01 (−0.60, 0.61)	−0.01 (−0.04, 0.02)	0.17 (0.12, 0.22)	0.05 (−0.50, 0.61)	0.00 (−0.03, 0.02)	0.17 (0.12, 0.22)
Digit Span-Forward longest sequence	0.18 (−0.17, 0.54)	−0.01 (−0.03, 0.00)	0.10 (0.07, 0.12)	0.23 (−0.10, 0.56)	−0.01 (−0.03, 0.00)	0.10 (0.07, 0.12)
Digit Span-Backward total trials	0.03 (−0.51, 0.57)	−0.01 (−0.04, 0.01)	0.16 (0.12, 0.20)	0.08 (−0.40, 0.57)	−0.01 (−0.03, 0.02)	0.16 (0.12, 0.20)
Digit Span-Backward longest sequence	0.06 (−0.27, 0.39)	0.00 (−0.02, 0.01)	0.09 (0.17, 0.12)	0.08 (−0.22, 0.38)	0.00 (−0.01, 0.02)	0.09 (0.07, 0.12)
Category Fluency: animals	0.33 (−0.98, 1.64)	−0.07 (−0.14, −0.01)	0.24 (0.14, 0.35)	0.46 (−0.80, 1.72)	−0.07 (−0.13, −0.01)	0.24 (0.14, 0.35)
Category Fluency: vegetables	−0.99 (−1.93, −0.05)	−0.09 (−0.13, −0.04)	0.09 (0.01, 0.16)	−0.83 (−1.74, 0.09)	−0.08 (−0.13, −0.04)	0.09 (0.01, 0.16)
Trail Making Part A, [†] time in seconds	−0.08 (−0.21, 0.06)	0.00 (0.00, 0.01)	−0.05 (−0.06, −0.04)	−0.10 (−0.22, 0.02)	0.00 (0.00, 0.01)	−0.05 (−0.06, −0.04)
Trail Making Part B, [†] time in seconds	−0.11 (−0.26, 0.05)	0.01 (0.00, 0.01)	−0.06 (−0.07, −0.05)	−0.15 (−0.28, −0.02)	0.01 (0.00, 0.01)	−0.06 (−0.07, −0.05)
WAIS Digit Symbol total items in 90 s	−0.10 (−3.80, 3.60)	−0.35 (−0.53, −0.18)	1.58 (1.34, 1.82)	0.74 (−2.08, 3.56)	−0.29 (−0.42, −0.15)	1.58 (1.34, 1.82)
Boston Naming Test total score	1.77 (0.58, 2.95)	−0.01 (−0.06, 0.05)	0.37 (0.28, 0.46)	1.76 (0.69, 2.83)	0.00 (−0.05, 0.05)	0.37 (0.28, 0.46)

Abbreviations: MMSE, Mini-Mental State Examination; WAIS, Wechsler Adult Intelligence Scale.

Coefficients significant at the 0.01 level are bolded.

^{*} These models also adjusted for the delay interval.[†] Log-transformed.

Table 4

Means and standard deviation by age and education category for cognitively normal Spanish-speaking elders

Age	69 years			70 to 79 years			80 years					
	<12 years		12 years	<12 years		12 years	<12 years		12 years			
Education range	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)		
MMSE: orientation	58	9.09 (1.19)	62	9.4 (0.76)	53	8.89 (1.22)	60	9.53 (0.68)	23	9.22 (1.13)	17	9.65 (0.61)
MMSE total score	58	27.4 (2.53)	62	28.48 (1.35)	53	26.58 (2.87)	60	28.68 (1.56)	23	27.96 (2.27)	17	28.06 (1.98)
Logical Memory A Immediate total units	50	10.76 (4.02)	57	11.89 (3.18)	41	9.27 (3.85)	52	12.29 (3.6)	17	9.29 (3.7)	15	10.8 (3.97)
Logical Memory A Delayed Recalls	50	8.8 (4.08)	57	10.68 (4.21)	41	7.49 (3.61)	52	10.37 (4.07)	17	6.94 (3.7)	15	9.2 (3.34)
Digit Span-Forward total trials	51	5.37 (2.23)	59	6.63 (1.82)	47	4.89 (1.91)	56	6.7 (1.86)	22	5.14 (2.1)	17	6.24 (1.68)
Digit Span-Forward longest sequence	51	5.2 (1.22)	59	5.95 (1.06)	47	4.94 (1.21)	56	5.79 (1.04)	22	4.91 (1.57)	17	5.41 (0.87)
Digit Span-Backward total trials	51	4 (1.47)	59	5.76 (1.81)	47	3.7 (1.68)	56	5.23 (1.67)	22	4.09 (1.77)	17	4.88 (1.54)
Digit Span-Backward longest sequence	51	3.29 (0.90)	59	4.31 (1.10)	47	3.13 (0.99)	56	4.14 (1.09)	22	3.55 (1.14)	17	3.82 (0.95)
Category Fluency: animals	57	16.35 (4.60)	59	18.61 (3.70)	51	14.67 (4.62)	58	17.66 (4.78)	23	13.74 (3.49)	17	16.76 (4.27)
Category Fluency: vegetables	54	12.17 (3.11)	59	12.83 (3.07)	50	10.26 (3.1)	55	11.6 (3.37)	23	9.65 (3.23)	15	12 (2.2)
Trail Making Part A, time in seconds	55	65.33 (27.11)	59	36.59 (13.98)	48	70.69 (39.32)	58	42.07 (17.34)	22	63.18 (27.17)	17	50 (26.11)
Trail Making Part B, time in seconds	52	181.88 (74.69)	59	115.07 (57.91)	42	200.76 (83.53)	57	118.91 (61.09)	20	226.75 (73.69)	16	144.75 (73.63)
WAIS Digit Symbol total items in 90 s	55	27.02 (10.71)	59	41.59 (10.37)	51	21.94 (11.1)	57	37.6 (10.07)	22	22.86 (8.62)	16	30.63 (10.89)
Boston Naming Test total score	52	22.23 (4.22)	59	25.24 (3.10)	49	20.82 (4.54)	53	24.7 (3.18)	22	21.91 (4.6)	17	24.82 (2.92)

Abbreviations: MMSE, Mini-Mental State Examination; WAIS, Wechsler Adult Intelligence Scale.