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Assessment and Diagnosis of Dementia in Hispanic and Non-Hispanic White Outpatients

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Purpose: We examined whether (a) neuropsychological test performance (NP) or (b) informant reports of patients' functional abilities or (c) behavioral and psychological symptoms (BPS) predicted dementia diagnoses to different degrees among Hispanic and non-Hispanic Whites (NHWs). ***Design and Methods:*** Our sample included 444 Hispanic and 444 (randomly selected from 11,081) NHW outpatients diagnosed with normal cognition or dementia at their initial evaluations. We tested for significant ethnic-group differences in dementia diagnosis predictors using NP and the 2 informant reports, covarying for age, sex, and education. ***Results:*** When using ethnic group–specific norms, NP and functional abilities predicted diagnosis in both groups with no significant differences but BPS was only significant in Hispanics. When using combined ethnic group norms, the only major difference was that BPS approached but did not meet statistical significance in Hispanics. ***Implications:*** Clinicians may be aware of the limitations of NP and may thus be informally adjusting their overall impressions of patients' NP among Hispanics and weighing certain tests differentially across ethnic groups when assessing dementia. Though these approaches may be aimed at reducing misdiagnosis, their effectiveness is questionable and they may be driving systematic differences in diagnosis within and across ethnicities. In addition, informant-reported functional abilities may be less sensitive to ethnicity-related influences and represent an important, ethnically neutral area in dementia assessment. The predictive value of informant-reported BPS in the diagnostic process across ethnic groups warrants further attention.

Key Words: Ethnicity, Latino/a, Neuropsychology, Functional Assessment Questionnaire, Neuropsychiatric Inventory Questionnaire

It is anticipated that there will be an increasing prevalence of dementia among elderly Hispanics. The number of older Hispanics with dementia is expected to increase drastically from less than 200,000 in 2000 to up to 1.3 million by 2050 (Alzheimer's Association, 2004). It is important to note that Hispanics are quite ethnically and racially heterogeneous. The U.S. Census created the label "Hispanic" to categorize people of Spanish-speaking Latin American ancestry, representing 21 different countries (Suárez-Orozco & Páez, 2002). Despite this heterogeneity, the reality is that the number of Hispanic Americans with dementia will likely continue to increase substantially faster than that of non-Hispanic whites (NHWs), pointing to the pressing need to better understand ethnic group differences in the diagnosis of dementia.

Dementia evaluations should ideally involve many sources of information, including medical history and assessments of neuropsychological test performance (NP), functional abilities, and behavioral and psychological symptoms (BPS). However, two primary sources of information for diagnosing dementia are NP and informant-based reports of cognitive abilities (Potter et al.,

2009). Although NP remains central in dementia diagnosis, it suffers from several limitations that highlight the need for the use of additional tools during diagnosis, especially among ethnic minority groups such as Hispanics. Premorbid intellectual ability, level and quality of education, and language and ethnocultural factors can affect NP, in that poorly educated patients may be misclassified as having dementia, whereas dementia in well-educated patients may not be captured (Le Carret, Lafont, Mayo, & Fabrigoule, 2003). Additionally, the norms for frequently used tests are often drawn from patients evaluated at tertiary care medical centers and control participants who may perform differently than more representative, diverse community samples. As such, across-group differences in NP are likely due to ethnic group biases among some tests, such as English language proficiency, literacy, educational attainment, and quality of education, as opposed to valid group differences in cognitive performance. However, the majority of prior studies of ethnic group differences in NP have demonstrated that disparities in scores remained even after matching participants on demographic and socioeconomic variables (Manly & Espino, 2004). These ethnic group differences can lead to reduced specificity of cognitive tests such that Hispanics with normal cognitive functioning (NCF) are at increased risk of being misdiagnosed with dementia compared with NHWs (Le Carret et al., 2003).

Other widely used sources of information during dementia evaluations are informant reports on patients' functional abilities and BPS. Clinicians frequently use informant-based reports as they have certain advantages over NP. For example, they are comparatively less affected by patients' premorbid ability and education level or dominant language proficiency than patients' NP, which may be based on inappropriate norms (Jorm, 2004). They also benefit from face validity because cognitive abilities are evaluated with regard to the ability to carry out instrumental activities of daily living (IADLs; e.g., shopping and managing finances) that tap abilities such as organizing, planning, and executing associated with living independently. Jorm argued that using NP and informant reports in combination can increase dementia diagnostic accuracy because informant reports provide additional information that is complementary to NP. These suggestions bear added importance for Hispanics for whom the use of NP as the primary basis for diagnosis may be less valid. Thus, it appears plausible that clinicians may rely on informant reports more strongly when assessing dementia among Hispanics compared with NHWs given their likely awareness of the limitations of NP.

Certain noncognitive changes also occur in many individuals with underlying cognitive impairment even before receiving a diagnosis of dementia. For example, Tabert and colleagues (2002) found that informant-reported functional deficits in patients with mild cognitive impairment (MCI), commonly viewed as a precursor of dementia, strongly predicted a future Alzheimer's disease (AD) diagnosis among outpatients evaluated at memory disorder centers, even after controlling for age, education, and Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) scores. Thus, changes in some individuals' functional abilities may represent the earliest stages of dementing disorders and be a valuable area to assess through informants.

The Functional Assessment Questionnaire (FAQ; Pfeffer, Kurosaki, Harrah, Chance, & Filos, 1982) is a frequently used, validated scale measuring patients' ability to conduct 10 IADLs to assist clinicians in the diagnosis of dementia. Although clinicians complete this questionnaire, their responses to each item are based on information provided directly from informants.

Informants also often recognize changes in patients' personality, behavior, and mood due to underlying dementia before receiving a dementia diagnosis. A prospective longitudinal study of older adults without dementia found that about half of the participants who later developed AD had already demonstrated personality changes according to informant-based reports beginning at least 1 year before diagnosis (Balsis, Carpenter, & Storandt, 2005). Therefore, similar to functional abilities, such BPS that are due to underlying dementia, even at earlier stages of the disease, may be reliably reported by patients' informants and can assist clinicians during assessment.

The Neuropsychiatric Inventory Questionnaire (NPI-Q; Cummings et al., 1994) is a widely used validated, informant-based questionnaire to evaluate the frequency of these kinds of changes (i.e., BPS) that have occurred within the past month among individuals with possible dementia. Such symptoms include hallucinations, disinhibition, and apathy.

Because two key sources of information clinicians' use when diagnosing dementia are NP and informant-based reports of patients' functional

abilities and BPS, a richer understanding of how clinicians may differentially weigh these variables across ethnic groups could provide insight into potential systematic differences in dementia diagnoses. The primary aim of this study was to examine whether NP and informant reports differentially predicted clinicians' diagnosis of dementia or NCF across Hispanic and NHWs. Given the inadequate diagnostic validity of neuropsychological tests among Hispanics, it is plausible that Hispanic patients often appear more impaired objectively (i.e., based on NP) than they actually are, which may also be inconsistent with their informants' reports. Clinicians may be aware of the limitations of NP among Hispanics and tend to rely more heavily on informant reports to obtain a clearer picture of patients' cognitive status. Therefore, we hypothesized that (a) NP would be a stronger predictor of a diagnosis of dementia or NCF in NHWs compared with Hispanic outpatients, and (b) informant reports of patients' functional abilities, and (c) BPS would be stronger predictors of diagnosis in Hispanics than NHWs.

Methods

Study Population and Procedure

Participants included outpatients and their informants enrolled in the longitudinal National Alzheimer's Coordinating Centers Alzheimer's Disease Center study at 32 centers nationwide. The Uniform Data Set (UDS) used in this study included data from 444 Hispanic and 444 (randomly selected out of 11,081 to reduce the chances of statistically significant findings due to high power and increase comparability across groups) NHW outpatients with a clinical diagnosis of either NCF or dementia at the time of initial evaluation. Exclusion criteria included cognitive impairment due to diagnoses of stroke and Parkinson's disease, MCI that did not result in a dementia diagnosis, and limited English proficiency. Neuropsychological assessments (in English) usually lasted approximately 1 hr and were generally conducted by a psychometrician with review by a neuropsychologist. Informants answered several questions about patients' cognitive and functional abilities and BPS.

Measures

Demographics.—Demographic variables included age, years of obtained education, sex, and ethnicity. Because these variables can potentially affect one's cognitive performance and risk for cognitive decline, we included these variables as covariates in the analyses.

Neuropsychological Measures.—The MMSE was used as a brief screening test for cognitive impairment. Thirty items assess memory, orientation, language, and attention.

Immediate and delayed recall of structured verbal material was assessed by Story A of the Logical Memory subtest of the Wechsler Memory Scale—Revised (Wechsler, 1987a). Participants were read a short story and asked to recall as much of the story as possible both immediately after presentation and after a 20- to 30-min delay.

The Digit Span Forward and Backward subtests of the Wechsler Adult Intelligence Scale—Revised (WAIS-R; Wechsler, 1987b) were used as measures of attention. Digit Span Forward requires participants to recall orally presented strings of numbers, whereas Digit Span Backward requires recitation in reverse order.

The WAIS-R Digit Symbol Coding subtest, similar to a transcription task, was used as one measure of processing speed. Processing speed was also assessed with the Trail Making Test Part A (Trails A; Reitan, 1958), a paper-and-pencil task requiring participants to draw lines connecting numbered circles.

Verbal fluency (i.e., category fluency) was measured by asking participants to orally generate items within the categories of animals and vegetables. Confrontation naming was assessed by asking participants to name line drawings of objects using the 30 odd-numbered items of the Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1983).

Various executive functions, including set shifting and mental tracking, were measured by performance on the Trail Making Test Part B (Trails B; Reitan, 1958). This task is similar to Trails A, though participants are expected to hold in mind two series (i.e., numbers and letters) and alternate between them, in order.

To obtain a measure of overall NP, we converted raw scores from each individual test into standardized scores for each ethnic group before creating a composite standardized NP score, with higher scores indicative of better overall NP. We calculated the means (*M*) and standard deviations (*SD*) for each test among Hispanics and NHWs without dementia, which served as the basis for standardization. The standardization process allowed each

of the tests to have equal weight despite differences in ranges of possible raw scores so that they were based on the same scale. Using ethnic group–specific norms (EGSN) also increases the validity of the neuropsychological findings. However, we also conducted analyses using norms based on the combined sample of both Hispanics and NHWs without dementia to compare findings derived from these norms to those using EGSN.

Informant-Reported Functional Abilities.—Informants completed the FAQ, which, as described earlier, measures patients' abilities to carry out IADLs. Activities that could not be rated, either because the patient did not previously usually carry them out before their cognitive decline began or the informant lacked ample information to supply a response, were not scored. Total scores range from 0 to 30, with higher scores representing more difficulty or requiring assistance with IADLs for more than 4 weeks. The FAQ was originally validated on 195 older adults aged 61–91 years in a stable retirement community, though there are currently no studies that have examined the validity of this scale among Hispanic patients or across ethnic groups. The Cronbach's alpha (α) values for this scale in this study's sample were 0.97 for Hispanics and 0.96 for NHWs.

Informant-Reported Behavioral and Psychological Symptoms.—Informants completed the NPI-Q, which, as noted earlier, measures patients' BPS occurrences. Total scores range from 0 to 12, with higher scores representing more BPS indicative of a change in patients in the past month. It should be noted that similar to the FAQ, the NPI-Q has not yet been validated among Hispanic patients or assessed for its psychometric properties across ethnic groups. The α values in this study's sample were 0.78 for Hispanics and 0.79 for NHWs.

Clinicians' Diagnosis of Cognitive Functioning.—Based on all the information available for each patient as part of the UDS, clinicians, whether individually or through consensus, responded with either "yes" or "no" to questions asking if the patient had (a) NCF (i.e., no MCI, dementia, or other neurological condition resulting in cognitive impairment); (b) met criteria for dementia in accordance with standard AD criteria (based on the National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association [NINCDS/ADRDA] Alzheimer's criteria; McKhann et al., 1984); (c) vascular dementia (based on the National Institute of Neurological Disorders and Stroke and Association Internationale pour la Recherche et l'Enseignement en Neurosciences [NINDS/AIREN] vascular dementia criteria; Román et al., 1993); or (d) demonstrated sufficient evidence of other non-Alzheimer's or vascular types of dementia.

Statistical Methods

To test our hypotheses, we ran multivariate binary logistic regression analyses for each ethnic group separately to obtain odds ratios (ORs) for each of the three key predictor variables with diagnosis, which was a binary variable (0 = NCF; 1 = dementia). We included age, sex, and education level as covariates. Given the multisite nature (i.e., clustered data) of this study, it is possible that variations in the diagnostic process or other characteristics like patient population and diagnosis distribution differed across sites. To account for the potentially confounding effect of site, we conducted our logistic regression analyses using the generalized estimating equations marginal models method with the GENMOD procedure in SAS 9.2, which uses a robust covariance matrix to take into consideration the correlation of measurements within sites (Agresti, 2007). When using this procedure, the interpretation of parameter estimates does not depend on the respective site; rather, it is valid for the whole population of sites and actually averages the effects of the predictors across sites. To examine whether there were significant ethnic group differences in the ORs for each predictor variable, we examined the statistical significance of the ORs and tested for an interaction as a means by which to determine significant differences in ORs across groups (Altman & Bland, 2003). Finally, we ran our analyses using both EGSN and combined ethnic group norms (CEGN) for NP.

Results

Table 1 provides descriptive statistics for the demographic and key variables stratified by both ethnicity and diagnosis (combined NCF and dementia, NCF only, and dementia only). Of the 444 Hispanic outpatients, 239 (53.8%)

were Mexican/Chicano/Mexican American, 81 (18.2%) were Puerto Rican, 26 (5.9%) were South American, 19 (4.3%) were Central American, 19 (4.3%) were Cuban, 8 (1.8%) were Dominican, 31 (7.0%) were classified as "other," and 21 (4.7%) were coded as "unknown." In addition, 305 (68.7%) reported that English was their primary language at the time of assessment. A total of 243 (54.7%) were diagnosed with dementia at their initial evaluations and the rest with NCF. Among the 444 NHWs, nearly all patients (98.4%; $N = 437$) reported that English was their primary language, and there was a similar percentage (52.3%; $N = 232$) of patients who were diagnosed with dementia rather than NCF compared with the Hispanic patients.

Table 1 also provides information regarding whether significant differences were found across groups among these variables. Of note, education levels were significantly lower among Hispanics than NHWs regardless of diagnosis, $p < .001$. For example, in the combined NCF and dementia sample, mean education level for Hispanics was 13.25 years ($SD = 3.93$) compared with 15.37 years ($SD = 3.16$) for NHWs.

Hypothesis 1 predicted that NP would be a stronger predictor of diagnosis in NHWs compared with Hispanics. When using EGSN (Table 2), our analyses revealed that NP had a statistically significant association with diagnosis in both groups such that poorer NP was associated with a dementia diagnosis. For the Hispanic patients, the OR for NP was 0.785 (95% confidence interval [CI; 0.740–0.833]; $p < .001$) and for NHWs, this value was 0.768 (95% CI [0.713–0.827]; $p < .001$). These ORs were not statistically significantly different from one another, which fails to support our hypothesis that NP would be a stronger predictor of diagnosis in NHWs compared with Hispanics.

Hypothesis 2 predicted that the FAQ would be a significantly stronger predictor of diagnosis in

Table 1. Participant Characteristics, Neuropsychological Test Performance (NP), and Informant Reports, by Ethnicity and Diagnosis

	All ($n = 888$), N (%)	NCF ($n = 413$), N (%)	Dementia ($n = 475$), N (%)	NCF vs. Dementia, p Value
Women				
Hispanic ($n = 444$)	261 (58.8)	139 (69.2)	122 (50.2)	<.001
NHW ($n = 444$)	247 (55.6)	125 (59.0)	122 (52.6)	.177
Prob (H_0)	0.342	0.031	0.604	—
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	p Value
Age (years)				
Hispanic ($n = 444$)	71.51 (10.31)	69.47 (9.70)	73.20 (10.51)	<.001
NHW ($n = 444$)	72.90 (10.21)	71.51 (9.63)	74.16 (10.57)	<.001
Prob (H_0)	0.045	0.033	0.318	—
Patient education (years)				
Hispanic ($n = 441$)	13.25 (3.93)	13.99 (3.65)	12.63 (4.05)	<.001
NHW ($n = 440$)	15.37 (3.16)	15.98 (2.63)	14.80 (3.48)	<.001
Prob (H_0)	<.001	<.001	<.001	
Overall NP (EGSN)				
Hispanic ($n = 444$)	−14.81 (17.61)	0.00 (8.28)	−27.05 (13.36)	<.001
NHW ($n = 444$)	−15.05 (19.52)	0.46 (7.17)	−29.22 (16.17)	<.001
Prob (H_0)	0.847	0.550	−0.114	—
Total FAQ score				
Hispanic ($n = 444$)	9.86 (10.92)	0.43 (1.47)	17.67 (9.03)	<.001
NHW ($n = 444$)	9.15 (10.31)	0.84 (2.87)	16.75 (8.64)	<.001
Prob (H_0)	.320	.066	.259	—
Total NPI-Q score				
Hispanic ($n = 444$)	2.38 (2.54)	0.80 (1.36)	3.68 (2.55)	<.001
NHW ($n = 444$)	2.38 (2.57)	0.89 (1.57)	3.74 (2.55)	<.001
Prob (H_0)	1.000	0.554	0.803	—

Note. NCF = normal cognitive functioning; NHW = non-Hispanic White; NP = overall appraisal of neuropsychological test performance; EGSN = ethnic group–specific neuropsychological test norms; FAQ = Functional Assessment Questionnaire; NPI-Q = Neuropsychiatric Inventory Questionnaire; Prob (H_0) = null hypothesis that group differences are not significant.

Table 2. Multivariate Logistic Regression of Neuropsychological Test Performance (Ethnic Group–Specific Norms) and Informant Reports on Diagnosis with Covariates, by Ethnic Group

Hispanics	*OR*	*SE*	Wald chi square	*p* Value	95% CI
Age (years)	1.009	0.031	0.080	.779	0.951–1.070
Female sex	0.305	0.578	4.211	.040	0.098–0.949
Education (years)	1.301	0.085	9.642	.002	1.102–1.536
Neuropsychological test performance	0.785	0.030	64.910	<.001	0.740–0.833
Total FAQ score	1.574	0.083	29.626	<.001	1.337–1.853
Total NPI-Q score	1.563	0.210	4.514	.034	1.035–2.360
Non-Hispanic Whites	*OR*	*SE*	Wald chi square	*p* Value	95% *CI*
Age (years)	0.972	0.030	0.883	.346	0.917–1.031
Female sex	0.469	0.600	1.590	.207	0.145–1.521
Education (years)	1.074	0.075	0.916	.339	0.928–1.244
Neuropsychological test performance	0.768	0.038	48.229	<.001	0.713–0.827
Total FAQ score	1.306	0.064	17.653	<.001	1.153–1.479
Total NPI-Q score	1.178	0.205	0.640	0.423	0.789–1.760

Note. FAQ = Functional Assessment Questionnaire; NPI-Q = Neuropsychiatric Inventory Questionnaire; *OR* = odds ratio; *SE* = standard error; 95% CI = 95% confidence interval.

Hispanics compared with NHWs. Results showed that the FAQ was significantly related to diagnosis in both groups such that higher scores (indicative of poorer functional abilities) were predictive of a dementia diagnosis. In the Hispanic sample, the OR for the FAQ was 1.574 (95% CI [1.337–1.853]; $p < .001$). In NHWs, the OR was 1.306 (95% CI [1.153–1.479]; $p < .001$). The ORs were not statistically significantly different from one another. Therefore, we could not conclude that the FAQ was a stronger predictor of diagnosis in Hispanics than NHWs.

Hypothesis 3 held that the predictive value of informant-reported BPS on diagnosis would be significantly stronger in Hispanics compared with NHWs. Analyses revealed that this variable was only significantly associated with diagnosis in Hispanics, OR = 1.563; 95% CI [1.035–2.360]; $p = .034$, though the differences in ORs across ethnic groups was nonsignificant. This finding suggests that higher BPS frequency scores were associated with a dementia diagnosis in Hispanics only but does not provide evidence for a significant ethnic group difference regarding the predictive value of BPS frequency on diagnosis.

There were two ethnic group differences among the covariates when using EGSN. First, the OR for education was significant only in Hispanics, OR = 1.301; 95% CI [1.102–1.536]; $p = .002$, suggesting that education only predicted diagnosis in Hispanics and not NHWs. More specifically, Hispanics with higher education levels were significantly more likely to obtain a dementia (rather than NCF) diagnosis at their initial evaluation than those with lower education levels in the context of this multivariate analysis. However, univariate analyses for both groups revealed that the OR for education was less than 1.000 (Hispanics: OR = 0.912; 95% CI [0.867–0.959]; $p < .001$; NHWs: OR = 0.883; 95% CI [0.829–0.941]; $p < .001$). Additionally, the ORs were not significantly different across groups, so we could not conclude that the predictive role of education on diagnosis demonstrated significant ethnic group differences. Second, male sex was a significant predictor of a dementia diagnosis among Hispanics only, with an OR of 0.305 (95% CI [0.098–0.949]; $p = .040$), but the ORs did not differ significantly across ethnic groups. Male sex remained a significant predictor in our univariate analysis for Hispanics (OR = 0.450; 95% CI [0.304–0.665]; $p < .001$), but not NHWs. It should be noted that these findings are likely artifacts of the study sample and design, which we later discuss in further detail.

When we reran our independent samples *t* tests and logistic regression analyses using CEGN, as expected, Hispanics performed significantly worse on NP than NHWs regardless of diagnosis. Among the combined NCF and dementia sample, the mean NP score was –21.71 (*SD* = 19.18) in Hispanics

Table 3. Multivariate Logistic Regression of Neuropsychological Test Performance (Combined Ethnic–Group Norms) and Informant Reports on Diagnosis with Covariates, by Ethnic Group

Hispanics	*OR*	*SE*	Wald chi square	*p* Value	95% CI
Age (years)	1.010	0.031	0.106	.744	0.950–1.074
Female sex	0.193	0.554	4.427	.035	0.105–0.923
Education (years)	1.266	0.080	8.746	.003	1.083–1.481
Neuropsychological test performance	0.818	0.023	78.704	<.001	0.782–0.855
Total FAQ score	1.597	0.093	25.150	<.001	1.330–1.918
Total NPI-Q score	1.549	0.230	3.620	.057	0.987–2.430
Non-Hispanic Whites	***OR***	***SE***	**Wald chi square**	***p* Value**	**95% CI**
Age (years)	0.972	0.030	0.889	.344	0.917–1.031
Female sex	0.470	0.603	1.572	.210	0.144–1.531
Education (years)	1.076	0.075	0.955	.328	0.929–1.246
Neuropsychological test performance	0.765	0.038	48.854	<.001	0.710–0.825
Total FAQ score	1.304	0.063	17.592	<.001	1.152–1.476
Total NPI-Q score	1.179	0.204	0.647	.421	0.790–1.758

Note. FAQ = Functional Assessment Questionnaire; NPI-Q = Neuropsychiatric Inventory Questionnaire; *OR* = odds ratio; *SE* = standard error; 95% CI = 95% confidence interval.

and –14.66 (*SD* = 19.33) for NHWs, $t(886) = 5.46$, $p < .001$. Among the NCF group, the mean score for Hispanics of –5.73 (*SD* = 8.93) was significantly lower than that of NHWs (*M* = 0.71, *SD* = 7.11), $t(381.89) = 8.08$, $p < .001$. Similarly, Hispanics in the dementia group (*M* = –34.93, *SD* = 14.83) performed significantly worse than their NHW counterparts (*M* = –28.70, *SD* = 16.00), $t(473) = 4.41$, $p < .001$.

Table 3 provides the results of the regression analyses presented separately by ethnic group using CEGN. These results were nearly identical to those from the analyses with EGSN. Most notably, the across-group difference between ORs for the association of NP and diagnosis remained nonsignificant. However, one key difference was that the informant-reported BPS was now no longer significantly related to diagnosis in Hispanics, though its *p* value of .057 approached significance and the OR value remained similar.

Discussion

The primary aim of this study was to test for ethnic group differences in the associations of NP and informant-reported functional abilities and BPS with a dementia diagnosis in Hispanic and NHW outpatients. When using EGSN, we found that informant-reported BPS was only significant among Hispanics and not NHWs, though we could not conclude that the predictive value of this variable differed significantly across groups. Both overall NP and informant-reported functional abilities were significantly associated with diagnosis in both groups to similar degrees. These results were independent of the covaried effects of age, sex, and education.

The relation between informant-reported BPS and diagnosis was only significant among Hispanics (in the context of EGSN) despite both groups having had nearly identical mean scores on this measure. Though we hypothesized that this association would be stronger among Hispanics, neither did we find evidence for this hypothesis nor did we anticipate finding a nonsignificant association among NHWs. Though many reasons may account for this finding, one plausible explanation is that some BPS such as depression, anxiety, and apathy may be due to causes other than dementia, and so perhaps clinicians did not consider them as related to dementia in NHWs as much as Hispanics. For instance, perhaps NHW informants were better able to communicate and express BPS to the English-speaking clinicians than Hispanics such that these BPS appeared more attributable to other causes, such as a mood disorder, rather than dementia. BPS are also susceptible to more subjective interpretation compared with functional abilities, which may also help account for this between-group difference.

Similarly, NHW informants and patients may have focused on cognitive changes more than BPS compared with Hispanics (Valle, 1994), and so clinicians possibly attended to cognitive changes more than BPS during assessment. Finally, clinicians may have relied so heavily on other variables such as NP (which clinicians may view as more valid in NHWs) and functional abilities, both of which tap the key criteria of a dementia diagnosis (i.e., decline in cognition and functioning; American Psychiatric Association, 2000) during evaluation that informant-reported BPS became a less important additional piece of information when diagnosing dementia in NHWs.

The finding that the association of NP with diagnosis did not differ significantly across ethnic groups when using CEGN was unanticipated. As previously discussed, it is well known that neuropsychological tests with nonrepresentative norms may not be well suited for Hispanics due various language, ethnocultural, and education factors (Manly & Espino, 2004). Because these norms place Hispanics at a disadvantage as evidenced by their significantly lower mean NP scores, it appeared plausible that NP should be much less strongly related to diagnosis among Hispanics, as these norms are not taking into account ethnic group differences. However, our results did not support this supposition. Moreover, there were no significant changes in the ORs for NP using EGSN compared with the ORs when using CEGN, suggesting that the role of NP is invariant across groups regarding its association with diagnosis. Despite the limitations of NP among Hispanics, clinicians may still have relied heavily on NP when assigning a diagnosis because this variable represents a more objective measure of cognitive functioning than informant-based reports. It is also possible that clinicians informally adjusted their overall impression of Hispanic patients' NP to account for the limited validity of many of the tests (e.g., tests within the domain of language) among this ethnic group. Evidence for this conjecture can be seen in the consistently lower NP mean values for Hispanics versus NHWs (i.e., about 6 standardized points lower) regardless of diagnostic category, a systematic ethnic group difference in terms of NP about which clinicians may be aware on some level. Additionally, because the Hispanic patients were English speaking (i.e., fluent enough to be assessed in English rather than Spanish) and had a relatively high mean level of education (13.25 years), clinicians may have been more likely to rely on NP to a greater degree than they would have if these patients lacked sufficient proficiency in English and education. Unfortunately, we could not directly test this hypothesis as these data do not include variables tapping potentially important factors pertaining to English language proficiency (e.g., literacy and number of years speaking English) and education (e.g., location or language of education). It is plausible to assume that higher levels of proficiency in the English language among the Hispanic patients would affect our results such that Hispanics would perform better on overall NP and more similarly to their NHW counterparts, a finding that may not be representative of the greater Hispanic American outpatient population.

The results of this study also revealed that the FAQ was a significant predictor of diagnosis in both ethnic groups. However, the FAQ did not appear to predict diagnosis to significantly different degrees across groups, in contrast with our hypothesis. This finding suggests that clinicians overall weighed informant-reported functional abilities relatively equally across ethnic groups during evaluation. It is possible that the ability to carry out IADLs may not be as sensitive to ethnocultural influences on informants' perceptions of changes in patients' abilities. In other words, a patient's ability to manage finances or remember appointments and events, for example, may not be as vulnerable to ethnically influenced interpretations as BPS like delusions and hallucinations. Furthermore, informants' reporting styles may not be as affected by ethnocultural or linguistic differences given the relatively objective nature of IADLs compared with BPS, which may be more difficult to effectively convey across ethnicities. Similarly, FAQ responses may be affected by noncognitive factors, such as physical disability, which may also be less sensitive to ethnicity-specific interpretations. In sum, we found that informant reports of patients' functional abilities (i.e., IADLs), as assessed by the FAQ, were ethnically neutral in this study in the dementia diagnostic process.

The finding that higher rather than lower educated Hispanics were more likely to be diagnosed with dementia in our multivariate analyses was unanticipated. However, this finding may be spurious, given that the association of education with diagnosis was in the anticipated direction in the univariate analyses for both groups. Also, sex was significantly associated with diagnosis in Hispanics

only in both our multivariate and univariate analyses. Specifically, Hispanic men compared with women had increased odds of having received a dementia diagnosis. A closer examination of the percentages of Hispanic women versus men in the two diagnostic groups revealed significantly more women in the NCF group (69.2%) than the dementia group (50.2%), $p < .001$. Moreover, as one example, the percentage of women in the United States in 2010 between 65–74 years was much lower (i.e., 53.5%), which would presumably be similar among Hispanic Americans (U.S. Census Bureau, 2012). This sex difference across diagnostic groups may be an artifact of volunteering for the Hispanic NCF group, as it has long been known that volunteers in longitudinal research are generally more likely to be women and well-educated (Streib, 1966). It is possible that the Hispanic men in this study were less likely to volunteer if they did not have dementia and may have only participated if their informants believed they did and thus brought them in for assessment. Therefore, there was an oversampling of women, especially among Hispanics, in this data set, which suggests that sex should not be considered an unbiased risk factor for dementia among Hispanics but rather an important covariate in our analyses.

The results of our logistic regression analyses with CEGN were notable for one key difference. The association of informant-reported BPS with diagnosis was no longer significant in Hispanics (and remained nonsignificant in NHWs), though the significance value approached .05 ($p = .057$) and the ORs remained nearly identical (1.549 vs. 1.563). This change may in part be due to the increase in the standard error value when using these norms. Given this difference in results when using the different NP norms, we can cautiously conclude that informant-reported BPS is possibly significant among Hispanics, though further research is needed to confirm this conclusion and elucidate the role of this measure on diagnosis both among Hispanics and in comparison with NHWs.

This study has certain limitations that suggest caution should be used in the interpretation of these results. First, the generalizability of these findings may be somewhat limited, as the UDS is essentially derived from a convenience sample of patients and informants who presented to academic AD clinics and is not fully representative of the general population. Second, our sample lacked enough power to examine differences across subgroups of the Hispanic outpatients, which could provide richer findings regarding differences across more specific ethnic groups. We also may have lacked power to detect significant differences in the ORs for the overall NP and FAQ variables across groups in our logistic regression models. Third, this data set lacked specific cultural variables such as acculturation (e.g., English literacy levels and number of years in the United States) or cultural values (e.g., familism). As such, we used ethnicity to classify our two samples, which is a proxy variable for culture and thereby limits our ability to explain our findings in terms of Hispanic cultural influences. Researchers should conduct similar studies using more of these kinds of specific cultural variables to provide richer insight into the cultural variables that may be influencing the assessment and diagnosis of dementia across ethnic groups. Fourth, these data did not include information on culture-bound syndrome diagnoses or symptomatology. As a result, we were unable to determine whether such syndromes influenced the assessment and diagnosis of dementia. Fifth, as previously noted, the FAQ and NPI-Q are yet to be validated among Hispanic patients or evaluated for their psychometric invariance across ethnic groups. We are currently working on testing the psychometric properties of these two scales for invariance across Hispanic and NHW patients. Finally, these data did not contain information on clinicians' perceptions of the utility of each diagnostic variable, or how much weight they assigned to each variable across ethnicities when evaluating dementia. Future research should directly assess clinicians' perceptions of the validity of NP and informant-report measures among individuals from diverse groups and those with limited English proficiency to assess their influences on dementia diagnoses. Such information could help us corroborate our supposition that clinicians may have informally adjusted their overall NP appraisals for Hispanics or weighed certain tests differentially across groups to account for the limited validity of neuropsychological tests in this group. Despite these limitations, this study also has a number of strengths, including the nationwide, multisite nature of the data characterized by standardized methods, the use of both patient and informant-reported data derived from validated measures and tests, the inclusion of a relatively large and diverse Hispanic sample, and the examination of both EGSN and CEGN.

In sum, the findings from this study call attention to several important clinical implications regarding ethnic group differences in clinicians' diagnosis of dementia. First, it appears as though clinicians may have been aware of the limited validity of many neuropsychological tests and thus informally adjusted their overall impressions of NP and weighed certain tests differentially across groups in an attempt to increase diagnostic validity. Though these approaches may have served to reduce the chances of misdiagnosis in some cases, it is unclear whether they are effective and they may be resulting in systematic differences in diagnosis both within and across ethnic groups. Clinicians should strive to use the most appropriate normative data for each individual patient where available, and the field should aim to create more representative normative test data for diverse ethnic groups that account for potentially important cultural variables. This suggestion bears additional relevance to Hispanics in particular, as English is often not their native or dominant language. Second, NP and informant-reported functional abilities are important predictors of diagnosis among both Hispanics and NHWs to similar degrees. The assessment of patients' functional abilities in particular may be an important area for clinical evaluation during the diagnostic process, as we found it to be ethnically neutral in this study and it represents one of the key diagnostic criteria for a dementia diagnosis. Finally, informant-reported BPS may be important in the diagnostic process among Hispanics only perhaps due to ethnocultural differences in the ability to communicate such symptoms and how they are perceived. Clinicians should be mindful of ethnocultural and linguistic differences in informant reporting styles of patients' BPS when assessing dementia to help improve diagnostic accuracy. Future research should examine the association of informant-reported BPS with diagnosis across diverse groups.

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