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The Functional Impact of HIV-Associated Neuropsychological Impairment in Spanish-Speaking Adults: A Pilot Study

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Abstract

Among English-speaking adults, HIV-associated neuropsychological (NP) impairments have been associated with problems in everyday functioning, including ability to function at work and drive an automobile. Latinos account for a disproportionate number of HIV/AIDS cases nationwide, and a significant segment of this population is primarily Spanish speaking. We have previously developed an assessment that evaluates English-speakers on a variety of instrumental activities of daily living. In this pilot study, we used Spanish-language translations of our functional battery to investigate the cultural relevance of such measures, and to explore relationships between NP status and ability to perform important everyday tasks in HIV-infected Spanish-speakers. Sixteen HIV-infected monolingual Spanish-speaking adults received comprehensive, Spanish language NP testing and functional assessments included the following domains: Medication Management, Cooking, Finances, Shopping, and Restaurant Scenario. Results revealed that most of the functional tasks appeared culturally relevant and appropriate with minor modifications. NP-impaired participants were significantly more functionally impaired compared to NP-normals (88% vs. 13%, $p < .01$). Performances on the functional assessment and the NP battery were also related to indicators of real world functioning, including employment status and quality of life. These results, though preliminary, suggest that Spanish language functional assessments are potentially valid tools for detecting everyday functioning deficits associated with NP impairments in HIV-infected Spanish-speakers.

Investigations into the neuropsychological (NP) impact of HIV/AIDS suggest involvement of frontal-striatal neural circuitry. Specifically, impairments have been observed in the areas of speed of information processing, attention/working memory, learning efficiency, executive functioning, and manual dexterity, with severity of impairment typically related to disease stage (Heaton et al., 1995; Martin et al., 2001; Miller et al., 1990).

HIV-related NP impairment has been associated with higher rates of unemployment, impairments in instrumental activities of daily living (ADLs), and decrements in driving ability (Albert et al., 1995; Heaton et al., 1996, 2001; Marcotte et al., 1999). Among the instrumental ADLs, medication management is of particular interest since adherence to prescribed regimens is key to the successful treatment of HIV infection (Albert et al., 1999;

Ferrando et al., 1998; Hinkin et al., 2001; Letendre et al., 1998; Letendre, Ellis, Rippeth, & McCutchan, 2000).

The preponderance of the above-mentioned work accomplished in the NP and functional assessment of HIV/AIDS has been done primarily with English-speaking, non-Hispanic White samples. However, HIV infection is spreading at an alarming rate among ethnic/cultural minority populations in the United States, and elsewhere. The Latino community is the fastest growing ethnic minority group in the United States. Current projections indicate that Latinos will be the nation's largest minority group by 2005, and that they may account for the majority of U.S. residents (51%) by the year 2050 (U.S. Census Bureau, 2000). Almost 40% of Latinos living in the United States were born in other, primarily Spanish-speaking countries, and there are well over 20 million adults in this country whose first language is Spanish (U.S. Census Bureau, 2000). The Latino community has also been disproportionately affected by the HIV/AIDS epidemic. Although Latinos represent 13% of the U.S. population, they account for 19% of the AIDS cases reported to the Centers for Disease Control (CDC, 2000). Furthermore, the rate of incident HIV-infection among Latinos (25.6 per 100,000) is more than three times the rate for non-Hispanic Whites (7.6 per 100,000).

Factors such as isolation due to language and nonmainstream culture, higher rates of poverty and substance use, and limited access to or use of health care services may each play a role in the increased rates, and possibly the virulence, of HIV-infection within this population (CDC, 2000). Despite these factors, there have been no systematic studies evaluating the NP and functional impact of HIV and AIDS in Spanish-speakers. Considering the relationship between NP impairment and functional declines in ADLs and vocational functioning observed in English-speakers, a practical need for investigation of these relationships among HIV+ Spanish-speakers becomes apparent. The purpose of this pilot study was to develop and evaluate Spanish-language translations of a previously developed functional assessment battery in order to: (1) explore the cultural relevance and appropriateness of the measures, and (2) investigate the relationships between NP status and everyday functioning in HIV+ Spanish-speaking adults.

METHOD

Participants

Sixteen HIV+ monolingual Spanish-speaking adults were recruited by the HIV Neurobehavioral Research Center (HNRC), an NIMH-funded center for the study of the prevalence, features, course and pathogenesis of HIV involvement in the central nervous system (CNS). As part of their participation in the HNRC, participants completed comprehensive neuromedical and NP assessments. In addition, all participants underwent a urine toxicology screen on the visit day, and all participants were negative for illicit substance use (i.e., nonprescribed stimulants, opioids, benzodiazepines, barbiturates, sedatives, etc.). Potential participants were excluded based on the presence of cognitive impairment that could be attributed to factors other than HIV illness (e.g., brain trauma with loss of consciousness greater than 30 mins, other neuromedical comorbidities, active substance abuse or dependence within the last 30 days, or evidence of learning disabilities or schizophrenia). Information on antiretroviral (ARV) medications was available for 14 of our 16 participants. Eleven of the 14 participants were on some form of an ARV medication regimen as prescribed by their respective primary care providers, for example, classic highly active antiretroviral therapy (HAART), protease inhibitor-sparing, nonnucleoside reverse transcriptase inhibitor (NRTI)-sparing, or other ARV therapy.

Fifteen participants were born in Mexico, with 1 person from Honduras. Participants had lived in the United States for an average of 7.1 ($SD=5.5$) years. The sample had a mean age of 33.7 ($SD=4.5$) years and a mean of 10.2 ($SD=3.8$) years of education, and 63% of the participants were male. The education of all the participants was completed in the country of origin, with the exception of 1 individual, from Mexico, who completed 7 out of 11 years of education in the US.

Procedure

Neuromedical Evaluation—All participants underwent neuromedical evaluations by Spanish-speaking professionals, which included: completion of structured clinical data gathering forms for medical history and symptoms; neurological and general physical examinations; and laboratory studies including CD4⁺ lymphocyte counts, routine hematology and chemistry, and urine toxicology. HIV serological status was determined by enzyme linked immunosorbent assays (ELISA) with Western Blot confirmation. CD4⁺ lymphocyte counts were quantified by a fluorescence-activated cell sorter (FACS). Participants were classified using the Centers for Disease Control HIV Disease Classification (CDC, 1992), which categorizes HIV-infected adolescents and adults based on clinical conditions associated with HIV infection and CD4⁺ T-lymphocyte count. The cohort included both individuals who were medically asymptomatic and those at more advanced disease stages. Fifty percent were medically asymptomatic or had generalized lymphadenopathy (CDC Stage A), 13% had minor opportunistic infections, constitutional symptoms, and/or peripheral neuropathies (Stage B), and 37% had a history of an AIDS-defining illness (Stage C). The total group's average CD4⁺ T cell count was 421.2 ($SD=316$), and 56% had an AIDS diagnosis.

Neuropsychological Evaluation—All participants completed a comprehensive NP battery in Spanish that was previously developed for a normative study of NP performance in Spanish-speakers. Tests were administered by trained bilingual psychometrists. Table 1 lists the tests in the four-hr battery, which assesses the following seven cognitive domains: attention/working memory, speed of information processing, verbal fluency, learning, delayed free recall, abstraction/executive functioning, and motor skills. Depressive symptomology was measured using the Spanish version of the Beck Depression Inventory (BDI; Beck & Steer, 1993). On average, participants were not significantly depressed ($M=8.2$, $SD=8.1$), although three participants reported mild to moderate levels of depression (i.e., >10 on the BDI).

The Spanish language NP battery included existing translated test versions where appropriate (Artiola i Fortuny, Hermosillo Romo, Heaton, & Pardee, 1999). In addition, English language tests were translated (with standard methods of forward and back translation) and/or modified as needed. As part of an NIMH-funded norms project, normative data were available from 172 HIV-negative neurologically normal Spanish-speaking volunteers, representing both genders, and a range of ages (20–54 years; $M=39.28$, $SD=7.52$) and educational levels (7–20 years; $M=13.54$, $SD=2.36$).

This NP battery was partially validated by demonstrating its ability to identify HIV-related cognitive deficits in a group of 30 HIV⁺ and 20 HIV⁻, demographically matched monolingual Spanish-speaking participants (Cherner, Artiola i Fortuny, Rivera Mindt, McCutchan, & Heaton, in preparation). NP test results for these 50 participants were evaluated using demographically corrected norms (Artiola i Fortuny et al., 1999), as well as norms from the above-mentioned NIMH-funded normative project at the HNRC. Test results of these 30 HIV⁺ participants, together with the 20 HIV⁻ age, education, and gender-matched controls, were then submitted to blind clinical ratings to assess the presence and

level of NP impairment (see Heaton, Kirson, Velin, Grant, & the HNRC Group, 1994 for details of this procedure). Global NP functioning and functioning in the seven ability areas covered by the battery were rated using the following ordinal, nine point scale: 1=above average functioning to 9=severe impairment; with scores of 5 or higher representing definite NP impairment.

The blind clinical ratings were performed independently by two bilingual neuropsychologists (MC & MRM). One hundred percent interrater reliability was established for the presence or absence of impairment, based on the global NP rating, and better than 95% correspondence was found for the individual NP domain ratings. The rate of global NP impairment in this sample was 63% among the HIV+ group and 15% among the HIV- group. The latter base rate of impairment in control subjects is similar to that found in English-speaking samples (Heaton et al., 1994).

For the current study, the same clinical ratings procedure was implemented. The clinical NP ratings were performed independently by two bilingual HNRC neuropsychologists (MC & MRM) for all 16 study participants.

A key factor in interpretation of NP assessment of a member of any minority group is level of acculturation (Ardila, 1998; Arnold, Montgomery, Castañeda, & Longoria, 1994; Manly et al., 1998). According to Berry (1997), acculturation can be broadly defined as the ability to understand and maneuver within a different, dominant culture from one's own. For the purposes of this study, acculturation was examined with a 12-item questionnaire, the *Short Acculturation Scale for Hispanics* (SASH; Marin, Sabogal, Marin, Otero-Sabogal, & Perez-Stable, 1987). This measure has demonstrated excellent internal reliability ($\alpha=.92$), and concurrent validity (Marin et al., 1987).

Translation of the Functional Assessment Battery—For the functional measures which were originally developed by Heaton et al. (2001), these measures were first translated into Spanish by a Master's level linguist and an experienced psychometrist (HB) under the supervision of a bilingual neuropsychologist and a bilingual senior psychometrist (MRM & YL, respectively). Following translation into Spanish, the functional measures were then back translated by another bilingual neuropsychologist (MC) utilizing standard translation methodology (Brislin, 1970, 1986). The translated measures were circulated among a Spanish speaking staff from six different linguistic regions (Argentina, Colombia, Mexico, Puerto Rico, Cuba, and Spain) in order to suggest appropriate refinements, and make the final measures as 'linguistically neutral' as possible. Where possible, as in the case of selected subtests from the *Direct Assessment of Functional Status* (DAFS), Spanish versions of instruments that were already available were directly included in the functional assessment battery (Lowenstein & Bates, 1992; Lowenstein, Rubert, Arguelles, & Duara, 1995).

Functional Evaluation—Two methodologies were used in order to evaluate the functional relevance of HIV-associated NP impairment: (1) objective, laboratory-based measures of capacity to perform tasks that are important in everyday living, and (2) manifest functioning measures, that is, reports of everyday functioning outside the laboratory. All of the functional measures used in this pilot study, in their English forms, have previously demonstrated adequate internal reliability and validity (Heaton et al., 2001; Lowenstein et al., 1989). The Spanish functional evaluations were administered by trained bilingual psychometrists.

Cultural relevance was evaluated in two ways. First, participants were asked specific questions regarding the cultural relevance and appropriateness of each functional measure

following its administration, that is, “How similar is this task to what you do in your daily life?” and “Would it be a problem if you could not complete the task in everyday life?” To evaluate cultural relevance, we reviewed participants' ratings and explanations of the similarity between the laboratory measures and their actual “real world” functioning. Cultural appropriateness was evaluated by reviewing participants' reports regarding their expectations about being able to complete each of the functional tasks in daily life, and the importance of each of the respective tasks to their ability to function adequately. Second, we examined the strength of the quantitative relationship between participants' performance on our functional laboratory measures and self-report of actual functioning in their daily lives (i.e., manifest functioning).

Laboratory Assessment—The objective levels of ADLs were measured using previously established tests (translated and back-translated versions, as described above). Each has a clear, objective scoring system with excellent reliability. A brief description of each assessment is as follows:

- 1) *DAFS Financial Skills* (Loewenstein et al., 1992): Participants are asked to identify, count and calculate currency, and complete basic financial transactions.
- 2) *DAFS Shopping Skills* (Loewenstein et al., 1992): Participants select 6 of 25 items from a previously presented grocery list.
- 3) *Cooking* (Heaton et al., 2001): Individuals are asked to follow recipes (including measuring, stirring, and wrapping items), and coordinate a meal so that food items are completed at approximately the same time. During this task, participants use a toaster oven, a hot plate as a “stove,” a microwave oven, and timers.
- 4) *Medication Management* (Heaton et al., 2001): Participants are asked to learn and follow a fictitious prescription regimen that is consistent with many of the current therapies that are used in the treatment of HIV.
- 5) *Restaurant Scenario* (Heaton et al., 2001): Participants are asked to order and pay for a meal within a specified budget, and specific tasks include correctly ordering items, totaling and paying for the bill, making correct change in order to leave an appropriate (previously specified tip), and staying within the budget.

Manifest Functioning—Participants completed an abbreviated *Katz Adjustment Scale – Patient* version (KAS–P; Katz & Lyerly, 1963). The KAS–P details the degree to which participants: (1) are able to complete chores and free-time activities; (2) whether this level of functioning meets their own expectations for each chore or activity; and (3) level of satisfaction with their current level of functioning. The KAS–P has adequate reliability (Ruff & Niemann, 1990), and has demonstrated sensitivity to changes in NP-related everyday functioning and life quality in patients who have traumatic brain injury (Klonoff, Snow, & Costa, 1986) and chronic obstructive pulmonary disease (McSweeney, Grant, Heaton, Adams, & Timms, 1982; McSweeney, Grant, Heaton, Prigatano, & Adams, 1985). Participants also completed the *Patient's Assessment of Own Functioning Inventory* (PAOFI; Chelune, Heaton, & Lehman, 1986), which is a 41-item questionnaire in which the participant reports the frequency with which he/she experiences difficulties in everyday life with various aspects of memory, language and communication, use of his/her hands, sensory-perception, and higher level cognitive and intellectual functions; additional questions asked about employment status and recreation activities. This instrument focuses on cognitive symptoms, and is used by clinicians in their determination of syndromic diagnoses according to the criteria delineated by the American Academy of Neurology AIDS Task Force (1991), as modified by Grant and Atkinson (1999; e.g., Minor Cognitive

Motor Disorder or HIV-Associated Dementia). All questionnaires were translated into Spanish and back-translated, in the manner described above previously.

Statistical Analyses

Similar to previous work accomplished with English-speaking HIV+ adults, a Functional Deficit Score was formulated in order to assess global functional impairment, based on performance on the multiple laboratory measures of activities of daily living (ADLs; Heaton et al., 2001). A separate deficit score (0=Normal to 5=Severe) was assigned for each of the functional measures, based upon functional battery distributions of a large sample ($n=116$) of English-speaking, NP-normal HIV-infected HNRC participants [0=>15%ile (i.e., 85% of normals were not classified as impaired), 1=7–15%ile, 2=3–6%ile; 3=1–2%ile; 4= < 1%ile; 5= < 1%ile]. Success or failure on each of the functional measures was determined based on the deficit score (i.e., *Pass*: Deficit Score=0 and *Fail*: Deficit Score>0). These individual deficit scores were then combined into a summary score, called the Functional Deficit Score (FDS), by computing for each participant the average of the individual deficit scores across all of the functional measures. This FDS defines presence/absence and level of global functional impairment, again based upon results of English-speaking, HIV+ NP-normal subjects (*Functionally Normal*: FDS=0 to 0.82 and *Global Functional Impairment*: FDS > 0.83, based on a 15% cut-point for the combined measures derived from the performance of the 116 NP-normal English-speaking HIV+ participants).

The normative standards on functional tasks derived from English-speaking HIV+ participants were tentatively used here because (1) data from a large sample of Spanish-speakers are not yet available, and (2) the everyday functioning tasks were designed to require comparable abilities to be successful, regardless of the language of administration.

Since clinical ratings of NP functioning use an ordinal scale, and scores from our functional measures are not normally distributed, nonparametric statistics were used in analyses of these variables. Spearman Rho (r_s) correlation coefficients were computed to assess the relationships between NP functioning (based on global clinical ratings) and global functional impairment (FDS). Participants were then organized into two groups, NP-normal and NP-impaired, based on their global clinical ratings (ratings of 5 or higher=NP-impaired). Chi-square tests for proportions were then computed to compare the groups' rates of impairment on the functional assessment measures. Specifically, NP status (NP-normal vs. NP-impaired) served as the independent variable, and global functional impairment status (i.e., FDS Normal vs. FDS Impaired) and “pass” versus “fail” on each of the ADL measures (as described above) served as the dependent variables.

As this is a pilot study and thus the sample size is small, we realize that p -value will not necessarily be a meaningful indicator of the results. Therefore, in addition to the p -value, we report Proportion Differences between groups as an indicator of minimal detectable group differences (i.e., effect size). In order to reduce the risk of Type II error, which is the greater risk with our small sample, Bonferroni corrections were not utilized. Alpha level to detect statistical significance was set at .05.

RESULTS

Participant Overview

Among the 16 HIV+ pilot study participants, 8 participants were classified as NP-normal and 8 as NP-impaired. Of those classified as NP-impaired, 5 had mild impairment and 3 had mild-to-moderate impairment. Only 1 subject met criteria for syndromic impairment (Minor Cognitive Motor Disorder). The most prevalent deficits among the NP-impaired individuals

were in neurocognitive domains of abstraction/executive functioning (86%), learning (63%), speed of information processing (50%), and attention/working memory (38%).

Independent-samples *t* tests and chi-square analyses revealed that there was no meaningful (or statistically significant, all *p*'s > .05) difference between the NP-normal and NP-impaired groups in: age [NP-normal *M*=34.6, *SD*=4.7; NP-impaired *M*=32.8, *SD*=4.3], education [NP-normal *M*=10.0, *SD*=4.9; NP-impaired *M*=10.4, *SD*=2.5], gender [NP-normal=63% Male; NP-impaired=63% Male], CD4 cell count [NP-normal *M*=366.5, *SD*=266; NP-impaired *M*=477, *SD*=369], AIDS status [NP-normal=63% AIDS; NP-impaired=50% AIDS], or level of depression [BDI Total Score; NP-normal *M*=6.4, *SD*=4.4; NP-impaired *M*=10.0, *SD*=10.7].

NP Status and Acculturation

The mean *Short Acculturation Scale for Hispanics* (SASH) total score (*M*=22.63, *SD*=9.29) for the entire group placed their acculturation level in the “More Latino than American” range (0–60 points possible, and higher scores indicate a higher level of acculturation). The range of scores was 12 (“Very Latino/Hispanic”) to 41 (“Almost fifty-fifty”). Only 3 participants were in the “Almost fifty-fifty” range, and the majority was in the “More Latino than American” range.

The relationship between NP functioning and acculturation was then evaluated. Global NP functioning in this group was not associated with overall acculturation level as defined by the total score on the SASH ($r_s = -.07$, $p = .78$). Furthermore, there was no significant difference between NP-normal and NP-impaired participants on the SASH total score; NP-normal *M*=24.13, *SD*=9.95; NP-impaired *M*=21.13, *SD*=8.99; $t_{(1)} = -0.63$, $p = .54$).

Cultural Relevance of Functional Measures

Similar to the previous observation with NP status, global functional status (based on the FDS) was also not associated with acculturation level as measured by the SASH total score ($r_s = -.02$, $p = .93$). Thus, our functional measures do not appear to be adversely affected by potential confounds associated with acculturation.

Qualitative review of the participants' responses regarding the functional measures revealed that most tasks were deemed moderately to highly culturally relevant and appropriate. Responses of NP-normal and NP-impaired participants were reviewed separately to evaluate whether there were qualitative differences on the perceived cultural relevance of the functional measures based on NP status. Results of this review revealed that there were no consistent differences between NP-impaired and unimpaired participants' responses regarding the cultural relevance of measures. In addition, a review was done to evaluate potential qualitative differences in cultural relevance based on the level of acculturation, and this revealed that level of acculturation was not associated with participants' responses regarding the cultural relevance of the tasks. Specifically, the responses of more highly acculturated participants were not qualitatively different from those of less acculturated participants. Therefore, the responses of all 16 participants were reviewed together for each functional measure.

All participants stated that the DAFS Shopping Skills task was generally quite similar to what they actually do in daily life, and that it was an important task for them. The DAFS Financial Skills task, which consists of fundamental financial transactions (i.e., identifying, counting, and calculating currency, and performing basic money transactions with cash) was also deemed highly culturally relevant and appropriate to what participants actually do in the real world.

The Restaurant Scenario task received moderate ratings for cultural relevance, and generally positive responses with regard to the task's appropriateness. It appeared that the two most limiting factors for this task were participants' infrequent restaurant dining in real life due to limited funds, and difficulty with calculating a tip in a manner common to the U.S. majority culture. Rather, some participants reported giving a flat rate of one or two dollars for tip (regardless of size of the bill) if the service was good. The Cooking task was also deemed moderately culturally relevant and appropriate. Some respondents reported that they rarely, if ever, used a microwave oven while cooking in their daily lives, while the use of the stove and regular oven was quite appropriate and consistent with cultural expectations. Recipes were reportedly used only for "exotic" or more complicated dishes, and relatively rarely in day-to-day life.

Lastly, the Medication Management test was rated as only mildly to moderately relevant to what participants do in their daily lives. It was clear that most subjects agreed that it was important to adhere to their medication regimens as prescribed, and as such, the purpose of the task seemed appropriate. However, virtually all of the participants who were taking their medications were using pill organizers, and often relied on their pharmacists to refill their prescriptions automatically (neither of which were features of the Medication Management test).

Neuropsychological Status and Everyday Functioning

Since acculturation level was not associated with either NP status or functional status, level of acculturation was not considered in analyses regarding the relationship between NP status and functional abilities. Overall NP functioning (based on the global clinical rating) was significantly associated with level of overall functional impairment (based on the FDS, $r_s = .68$, $p = .004$). NP-impaired participants demonstrated a significantly higher rate of global functional impairment (based on the FDS) when compared to NP-normals (88% vs. 13%; $\chi^2_{(1)} = 10.12$, $p = .002$; Proportion Difference = 75%). NP status predicted global functional impairment status as demonstrated by 88% sensitivity and 88% specificity. Moreover, the mean FDS of NP-normal individuals was well within the normal range (even while using English-language standards), while the mean FDS of the NP-impaired group was twice the level necessary to meet criteria for global functional impairment [$M = 0.48$, $SD = 0.43$ vs. $M = 1.73$, $SD = 1.05$].

Figure 1 displays the rates of failure for specific ADL domains among NP-normal and NP-impaired participants. NP-impaired participants demonstrated significantly higher rates of failure on the DAFS Financial Skills and the Restaurant Scenario (respectively, $\chi^2_{(1)} = 4.19$, $p = .04$; Proportion Difference = 50%; and $\chi^2_{(1)} = 6.90$, $p = .009$, Proportion Difference = 63%). The NP-impaired group was three times as likely to fail the Medication Management task ($\chi^2_{(1)} = 1.31$, $p = .24$, Proportion Difference = 25%), and twice as likely to fail the Cooking task ($\chi^2_{(1)} = 0.43$, $p = .51$, Proportion Difference = 14%) compared to the NP-normal group. None of the participants from either group failed the DAFS Shopping Skills task.

Analyses were then conducted to evaluate the relationship between NP status and manifest functioning. According to responses on the KAS-P, the expectations of NP-impaired participants regarding their life quality were lower compared to their NP-normal counterparts (NP-normal $M = 3.15$, $SD = 0.49$; NP-impaired $M = 2.66$, $SD = 0.52$; $t_{(1)} = -1.66$; effect size = 1.0). According to the PAOFI responses, the NP-normal group was more than twice as likely to be employed compared to NP-impaired group (38% vs. 14%; $\chi^2_{(1)} = 1.07$, $p = .30$, Proportion Difference = 23%). NP-impaired participants' were also more likely to report a perceived decline in their cognitive functioning at a higher rate than NP-normal participants (50% vs. 29%; $\chi^2_{(1)} = 0.72$, $p = .39$, Proportion Difference = 21%).

Lastly, global functional impairment, based on our laboratory measures (i.e., FDS), was also associated with manifest functioning. Although our sample size was small, functionally impaired participants ($n=8$) were almost three times as likely to be unemployed compared to their functionally normal counterparts, (50% vs. 14% unemployed; $\chi^2_{(1)}=2.77$, $p=.25$, Proportion Difference=36%). Furthermore, the functionally impaired group was almost twice as likely to report a perceived decline in cognitive functioning, according to their responses on the PAOFI, compared to the functionally normal group (50% vs. 29%; $\chi^2_{(1)}=0.72$, $p=.39$, Proportion Difference=21%).

DISCUSSION

The first goal of this pilot study was to ascertain whether Spanish-language translations of an existing functional battery were culturally relevant and appropriate. Based on quantitative analyses and qualitative review of participants' feedback, the results suggest that most Spanish versions of the functional measures were culturally relevant (with minor modifications), appropriate, and generally related to participants' "real world" functioning. However, the qualitative responses also suggest that additional refinements to the functional battery (particularly the Medication Management task) are necessary. Consequently, modification of these functional measures has already been undertaken in order to maximize the cultural relevance and appropriateness of these measures.

The second goal of this study was to evaluate whether, consistent with what is seen in English-speaking HIV-infected subjects, HIV-associated NP impairment in Spanish-speakers was related to problems in everyday functioning. Our findings, though preliminary, indicate that HIV-associated NP impairment is strongly related to global functional impairment, based on the Functional Deficit Score (FDS), a summary index including all five functional measures. NP-impaired participants also demonstrated higher rates of functional impairment on the majority of the individual functional measures (including DAFS Financial Skills, Restaurant Scenario, Medication Management, and Cooking), with the exception of DAFS Shopping Skills. Global NP status appears to be a particularly promising predictor of functional status (as defined by the FDS), with excellent sensitivity and specificity. Moreover, neither neuropsychological nor functional impairment was affected by the degree of acculturation in this group, but both were associated (albeit not statistically significantly so) with self-report of life quality experiences, as well as other real world indicators of functioning such as employment status.

Systematically evaluating the possible role of acculturation in determining performance on Spanish language NP and functional measures was beyond the scope of this pilot investigation. However, since previous studies suggest that acculturation is an important factor in effectively interpreting NP assessments of members of minority groups (Ardila, 1998; Arnold et al., 1994; Manly et al., 1998), a measure of acculturation was included in this study in order to aid in the interpretation of the NP and functional assessments. The fact that, unlike previous studies, the current study found no association between NP results and acculturation certainly does not refute previous findings. Unlike previous studies that associate raw scores (or scaled scores with age corrections based on majority norms) with acculturation, the Spanish NP test battery in this study was designed to be appropriate for Spanish-speaking Latinos and *normed* on Spanish-speaking Latinos, and the NP variables of interest (global NP ratings) were based on demographically corrected *T* scores rather than raw data. Therefore, a lack of association between our NP findings and acculturation might have been expected given the fact that demographically corrected NP variables were used in this investigation.

With respect to the lack of correlation between acculturation and performance on functional measures, the authors of these measures took great pains to make the translations of these functional tasks culturally appropriate. In addition, adjustments to these measures were made based on pilot participants' feedback in order to make the functional measures as culturally appropriate and relevant as possible. Consequently, since these tasks have already been carefully designed and modified in order to be culturally relevant, it would not be expected that they would be strongly associated with acculturation level.

Although the current results are promising, this small pilot study only represents a necessary first step. Additional research with much larger subject samples is needed in order to confirm or refute these preliminary findings. It is recommended that future studies prospectively evaluate the relationships between HIV-associated NP impairment and everyday functioning among Spanish-speaking adults, using refined functional measures. Specifically, inclusion of more culturally relevant aspects to the Medication Management task (i.e., use of pill organizer), and modification of some aspects of the Restaurant Scenario and Cooking tasks is needed. Moreover, the relationships between acculturation and performance on neuropsychological and functional measures need to be evaluated among a much larger group of Spanish-speakers in order to interpret the current findings better.

As new treatment agents become available with satisfactory penetrance into the CNS, possibilities are enhanced for significant improvements in cognitive functioning with pharmacologic intervention. Thus, valid assessments of everyday functioning may also serve as useful additions to neuropsychological testing, both as indicators of ability to comply with medication regimens and as direct measures of treatment efficacy. In particular, these new assessment methods could be uniquely helpful in establishing the relevance of treatment gains to patients' productivity, independence, and life quality. Clinical trials for new medications require sensitive neurobehavioral diagnostic and outcome measures that are appropriate for *all* study participants. Therefore, anticipating the inclusion of Spanish-speakers in clinical trials, as well as in other research and clinical settings, linguistically and culturally appropriate evaluation of neuropsychological and everyday functioning is required. As the demographics of this country and this disease continue to evolve, so must our diagnostic and outcome measures.

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REFERENCES

- Albert SM, Marder KM, Dooneief G, Bell K, Sano M, Todak G, Stern Y. Neuropsychologic impairment in early HIV infection: A risk factor for work disability. *Archives of Neurology*. 1995; 52:525–530. [PubMed: 7733849]
- Albert SM, Weber CM, Todak G, Polanco C, Clouse R, McElhiney M, Rabkin J, Marder K. An observed performance test of medication management ability in HIV: Relation to neuropsychological status and medication outcomes. *AIDS and Behavior*. 1999; 3:121–128.
- American Academy of Neurology AIDS Task Force. Nomenclature and research case definitions for neurologic manifestations of human immunodeficiency virus-type 1 (HIV-1) infection. *Neurology*. 1991; 41:778–785. [PubMed: 2046917]
- Ardila A. Bilingualism: A neglected and chaotic area. *Aphasiology*. 1998; 12:131–134.
- Arnold BR, Montgomery GT, Castañeda I, Longoria R. Acculturation and performance on selected Halstead–Reitan neuropsychological tests. *Assessment*. 1994; 1:239–248.

- Artiola i Fortuny, L.; Hermsillo Romo, D.; Heaton, RK.; Pardee, RE, III. Manual de normas y procedimientos para la batería neuropsicológica en Español. In Press; Tucson, AZ: 1999.
- Beck, AT.; Steer, RA. Beck Depression Inventory Spanish Translation. The Psychological Corporation; San Antonio, TX: 1993.
- Berry JW. Immigration, acculturation and adaptation. *Applied Neuropsychology*. 1997; 46:5–68.
- Brislin RW. Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology*. 1970; 1:185–216.
- Brislin, RW. The wording and translation of research instruments. In: Lonner, WJ.; Berry, JW., editors. *Field methods in cross-cultural research*. Sage Publications; Beverly Hills, CA: 1986.
- Centers for Disease Control. 1993 revised classification system for HIV infection and expanded surveillance case definition for AIDS among adolescents and adults. *Morbidity and Mortality Weekly Report*. 1992; 41:1–19.
- Centers for Disease Control. Surveillance fact sheet. 2000. HIV/AIDS among Latinos in the United States. issued September 2000
- Chelune, GJ.; Heaton, RK.; Lehman, RAW. Neuropsychological and personality correlates of patients' complaints of disability. In: Gerald Goldstein, RET., editor. *Advances in clinical neuropsychology*. Vol. Vol. 3. Plenum Press; New York, NY: 1986. p. 95-126.
- Cherner, M.; Artiola i Fortuny, L.; Rivera Mindt, M.; McCutchan, A.; Heaton, RK. Validation of a Spanish language neuropsychological battery in HIV-infected subjects. In Preparation
- Ferrando S, van Gorp W, McElhiney M, Goggin K, Sewell M, Rabkin J. Highly active antiretroviral treatment in HIV infection: Benefits for neuropsychological function. *AIDS*. 1998; 12:65–70. [PubMed: 9456256]
- Grant, I.; Atkinson, JH. Neuropsychiatric aspects of HIV infection and AIDS. In: Sadock, BJ.; Sadock, VA., editors. *Kaplan and Sadock's Comprehensive Textbook of Psychiatry/VII*. Williams and Wilkins; Baltimore: 1999. p. 308-335.
- Heaton RK, Grant I, Butters N, White DA, Kirson D, Atkinson JH, McCutchan JA, Taylor MJ, Kelly MD, Ellis RJ, Wolfson T, Velin R, Marcotte TD, Hesselink JR, Jernigan TL, Chandler J, Wallace M, Abramson I, the HNRC Group. The HNRC 500 – Neuropsychology of HIV infection at different disease stages. *Journal of the International Neuropsychological Society*. 1995; 1:231–251. [PubMed: 9375218]
- Heaton, RK.; Kirson, D.; Velin, RA.; Grant, I.; the HNRC Group. The utility of clinical ratings for detecting cognitive change in HIV infection. In: Grant, I.; Martin, A., editors. *Neuropsychology of HIV Infection*. Oxford University Press; New York: 1994. p. 188-206.
- Heaton RK, Marcotte TD, White DA, Ross D, Meredith K, Taylor MJ, Kaplan R, Grant I. Nature and vocational significance of neuropsychological impairment associated with HIV infection. *The Clinical Neuropsychologist*. 1996; 10:1–14.
- Heaton RK, Moore DJ, Marcotte TD, Reicks CJ, Weinberger K, Grant I, the HNRC Group. Everyday functioning in individuals with HIV-associated neuropsychological impairment. *Journal of the International Neuropsychological Society*. 2001; 7:229–230.
- Hinkin C, Castellon S, Lam M, Hardy D, Stefaniak M, Zolnikov B. Neuropsychological compromise predicts poor medication adherence in HIV+ adults [Abstract]. *Journal of the International Neuropsychological Society*. 2001; 7:230.
- Katz MM, Lyerly SB. Methods for measuring adjustment and social behavior in the community: I. Rationale, description, discriminative validity and scale development. *Psychological Reports*. 1963; 13:503–535.
- Klonoff PS, Snow WG, Costa LD. Quality of life in patients two to four years after closed head injury. *Neurosurgery*. 1986; 19:735–743. [PubMed: 3785620]
- Letendre S, Ellis R, Heaton RK, Atkinson JH, Nelson J, Grant I, McCutchan JA. Change in CSF RNA level correlates with the effects of antiretroviral therapy in HIV-1 associated neuro-cognitive disorder [Abstract]. *Journal of Neurovirology*. 1998; 4:357.
- Letendre S, Ellis R, Rippeth J, McCutchan A. Reduction of CSF HIV RNA levels correlates with reversal of HIV-induced cognitive dysfunction [Abstract]. *Journal of Neurovirology*. 2000; 6:246.

- Lowenstein DA, Amigo E, Duara R, Guterman A, Hurwitz D, Berkowitz N, Wilkie F, Weinberg G, Black B, Gittelman B, Eisdorfer C. A new scale for the assessment of functional status in Alzheimer's disease and related disorders. *Journal of Gerontology*. 1989; 44:114–121.
- Lowenstein, DA.; Bates, BC. Manual for administration and scoring the Direct Assessment of Functional Status scale for older adults (DAFS). Mount Sinai Medical Center; Miami Beach, FL: 1992.
- Lowenstein DA, Rubert MP, Arguelles T, Duara R. Neuropsychological test performance and prediction of functional capacities among Spanish-speakers and English-speaking patients with dementia. *Archives of Clinical Neuropsychology*. 1995; 10:75–88. [PubMed: 14589730]
- Manly JJ, Miller SW, Heaton RK, Byrd D, Reilly J, Velasquez RJ, Saccuzzo DP, Grant I, the HNRC Group. The effect of African-American acculturation on neuropsychological test performance in normal and HIV-positive individuals. *Journal of the International Neuropsychological Society*. 1998; 4:291–302. [PubMed: 9623004]
- Marcotte TD, Heaton RK, Wolfson T, Taylor MJ, Alhassoon O, Arfaa K, Grant I, the HNRC Group. The impact of HIV-related neuropsychological dysfunction on driving behavior. *Journal of the International Neuropsychological Society*. 1999; 7:579–592. [PubMed: 10645701]
- Marin G, Sabogal F, Van Oss Marin B, Otero-Sabogal R, Perez-Stable EJ. Development of a short acculturation scale for Hispanics. *Hispanic Journal of Behavioral Sciences*. 1987; 9:183–205.
- Martin EM, Sullivan TS, Reed RA, Fletcher TA, Pitrak DL, Weddington W, Harrow M. Auditory working memory in HIV-1 infection. *Journal of the International Neuropsychological Society*. 2001; 7:20–26. [PubMed: 11253838]
- McSweeney AJ, Grant I, Heaton RK, Adams KM, Timms RM. Life quality of patients with chronic obstructive pulmonary disease. *Archives of Internal Medicine*. 1982; 142:473–478. [PubMed: 7065785]
- McSweeney AJ, Grant I, Heaton RK, Prigatano GP, Adams KM. Relationship of neuropsychological status to everyday functioning in healthy and chronically ill persons. *Journal of Clinical and Experimental Neuropsychology*. 1985; 7:281–291. [PubMed: 3998092]
- Miller EN, Selnes OA, McArthur JC, Satz P, Becker JT, Cohen BA, Sheridan K, Machado AM, Van Gorp WG, Visscher B. Neuropsychological performance in HIV-1 infected homosexual men: The Multicenter AIDS Cohort Study (MACS). *Neurology*. 1990; 40:197–203. [PubMed: 2405289]
- Ruff RM, Niemann H. Cognitive rehabilitation versus day treatment in head-injured adults: Is there an impact on emotional and psychosocial adjustment? *Brain Injury*. 1990; 4:339–347. [PubMed: 2252966]
- U.S. Census Bureau. Press release CB00-ff. 2000. Census facts for Latino Heritage Month. 11, issued September 11, 2000

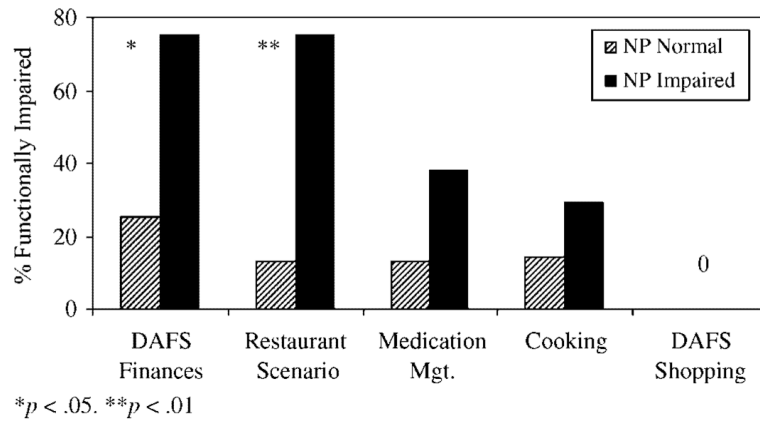


Fig. 1.
Domains of functional impairment by NP status.

Table 1

Summary of Neuropsychological Tests Administered for Each Cognitive Domain.

Speed of information processing
WAIS-III Digit Symbol & Symbol Search
Stroop Task
Trail Making Test, Part A
Learning and delayed recall (2 domains)
Story Memory Test
Hopkins Verbal Learning
Figure Memory Test
Brief Visuospatial Memory Test
Abstraction/executive functioning
Wisconsin Card Sorting Test (64-item)
Trail Making Test, Part B
Verbal fluency
Controlled Oral Word Association Test (COWAT-PMR)
Category Fluency (Animals)
Attention/working memory
WAIS-III Letter-Number Sequencing
Paced Auditory Serial Addition Test
Motor
Grooved Pegboard Test (Dominant & NonDominant Hands)
