Disparities in Cognitive Functioning of U.S. Older Adults by Race and Hispanic Origin

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Abstract

Objective: To determine if functioning in specific cognitive domains (verbal memory, working memory, numeracy) varies between non-Hispanic White (NHW), non-Hispanic Black (NHB), and Hispanic subpopulations in the United States.

Data/Methods: We used data from the 2010 observation wave of the Health and Retirement Study. The final sample included 18,982 participants aged 51 or older who completed a modified version of the Telephone Interview for Cognitive Status. Ordinary Least Squares regression models were used to examine differences in verbal memory, working memory, and numeracy by race, ethnicity and Hispanic subpopulations (Mexican, Cuban, Puerto Rican, other Hispanic). All models adjusted for demographic and health characteristics.

Results: NHW had the highest scores for verbal memory, working memory, and, numeracy. Among the Hispanic subpopulations, Puerto Ricans had significantly lower scores for verbal memory and working memory compared to Mexicans and Cubans. NHB had significantly lower scores for verbal memory and working memory compared to Mexicans and Cubans. Greater educational attainment was associated with higher functioning in all cognitive domains, but education had the greatest effects for working memory and the smallest effects for numeracy, especially for NHB and Hispanic subpopulations.

Discussion: This study identified significant disparities in specific cognitive domains according to race/ethnicity. Important differences in cognitive functioning among Hispanic subpopulations were also detected. Continued research is necessary to identify potential causes for the differences in cognition among Hispanic subpopulations.

Keywords: Cognition; Older Adults; Race/Ethnicity; HRS; USA.

Introduction

The older adult population in the United States is becoming increasingly diverse. In 2014 an estimated 4.2 million African Americans aged 65 and older were living in the United States, which accounted for 13.2% of the older adult population (Colby & Ortman, 2015). Hispanics have become the largest minority group in the United States (Jacobsen, Kent, Lee, & Mather, 2011) and represent a significant portion of the older adult population. The number of older Hispanic adults is projected to more than double over the next 50 years from approximately 5.5 million in 2014 to 11.9 million in 2060 (Colby & Ortman, 2015). Conversely, the number of non-Hispanic White (NHW) older adults is projected to decline from 19.8 million (62.2% of older adult population) in 2014 to 18.2 million (43.6% of older adult population) by 2060 (Colby & Ortman, 2015).

The growing diversity of the older adult population has important implications for cognitive aging in the United States. Hispanic and non-Hispanic Black (NHB) older adults have consistently been observed to have lower cognitive functioning compared to NHW older adults (Diaz-Venegas, Downer, Langa, & Wong, 2016; Sloan & Wang, 2005; Zsembik & Peek, 2001). Non-Hispanic Black older adults are also at an increased risk for dementia compared to NHW (Plassman et al., 2007; Potter et al., 2009), but there is not clear evidence that Hispanics are at an increased risk for dementia compared to NHW (Langa, Kabeto, & Weir, 2009; Mayeda, Glymour, Quesenberry, & Whitmer, 2016). However, older Hispanics have been observed to be diagnosed with dementia at a younger age (O'Bryant et al., 2013) and to exhibit more severe symptoms at the time of diagnosis (O'Bryant, Humphreys, Schiffer, & Sutker, 2007) when compared to NHW. The race and ethnic disparities in cognitive functioning are likely due to a culmination of factors including high prevalence rates of chronic health conditions associated

with dementia (Mayeda, Whitmer, & Yaffe, 2015; Whitmer, Gunderson, Barrett-Connor, Quesenberry, & Yaffe, 2005), socioeconomic disadvantages (Clouston, Glymour, & Terrera, 2015; Stern et al., 1994), and low literacy (Mehta et al., 2004).

An important feature of the extant literature on race and ethnic disparities in cognitive functioning is that Hispanics are not separated by country or region of origin. Over 50% of Hispanics living in the Unites States are of Mexican origin, but a growing proportion of the population includes Hispanics of Puerto Rican, Central and South American, and Cuban descent (González-Barrera & Lopez, 2013). This diversity contributes to differences among Hispanic subpopulations in educational attainment (Everett, Rogers, Hummer, & Krueger, 2011), socioeconomic status (Arias, 2010), and health (Dominguez et al., 2015). These characteristics are all related to cognitive functioning in old age and differences in education, socioeconomic status, and health may contribute to important differences in cognitive functioning between Hispanic subpopulations.

A second important characteristic of prior research on race and ethnic cognitive disparities is studies have primarily used global measures of cognition and research into differences in individual cognitive domains is limited. An exception is a study by Cagney and Lauderdale (2002) that reported older Hispanics and NHW had similar scores for memory, working memory, and orientation through high school. Although, Hispanics did not experience as great of a benefit of increasing education following high school for these three cognitive domains compared to NHW (Cagney & Lauderdale, 2002).

Examining specific cognitive domains can provide insight into if race and ethnic disparities in cognition are due to poor performance in certain cognitive domains or to a cumulative effect of poor functioning across multiple cognitive domains. This paper examines

differences in cognitive functioning in three domains (verbal memory, working memory, and learning) by race and Hispanic subpopulation. We use data from the 2010 observation wave of the Health and Retirement Study (HRS), which includes an over-sampling of Hispanic and NHB older adults. This over-sampling allowed us to examine differences in specific cognitive domains between Hispanic and non-Hispanic White older adults and differences among Hispanic subpopulations.

Data and Methods

Sample

The HRS is a nationally representative cohort of Americans 51 years or older. Baseline data collection began in 1992 (82% response rate) and follow-up interviews have been conducted every 2 years. New cohorts of adults aged 50-59 have been added approximately every 6 years (Health and Retirement Study, 2011). The HRS has included a statistical oversampling of African Americans and Hispanics at a rate of approximately 2 to 1 at each observation wave (Health and Retirement Study, 2008). Oversampling in 2004 and 2010 was affected by the introduction of the baby boomer cohorts, which increased the available pool of NHW and, consequently, reduced the relative sample size of minority participants (Health and Retirement Study, 2011). This problem was addressed in 2010 by increasing the oversampling of African Americans and Hispanics in the baby boomer cohorts which resulted in additional respondents for each minority group (Ofstedal & Weir, 2011).

A total of 20,101 respondents were interviewed during the 2010 observation wave. For the purposes of the present analysis, we only considered non-institutionalized respondents aged 51 or older who completed the interview without the help of a proxy, completed the cognitive questionnaire, and provided information on race and ethnicity. For the regression analysis we

further exclude 88 subjects with missing information for one or more covariates (see Measures). The final sample consisted of 18,982 subjects. The 1,119 respondents who were excluded were, on average, slightly older, predominantly non-Hispanic white, and had a lower total cognition score than the analytic sample.

Measures

Cognitive functioning has been assessed in the HRS using a modified version of the Telephone Interview for Cognitive Status (TICS-M) (Brandt, Spencer, & Folstein, 1988). The TICS-M is comprised of 12 items with a score range of 0-35 points. We used a further modification implemented by Langa et al. (2009) and Crimmins and colleagues (2011) with a score range of 0-27 because participants younger than 65 were not asked to recall the names of the president and vice president or the object and date naming items. A detailed summary of the cognitive measures used in this study can be seen elsewhere (Díaz-Venegas, Downer, Langa, & Wong, 2016). The 27-point version of the TICS-M includes measures for verbal memory (immediate and delayed recall of a 10-item word list, 0-20 points), working memory (Serial 7, 0-5 points), and numeracy (counting backwards for ten continuous numbers, 0-2 points).

Covariates

Characteristics that have been identified as being predictors of cognitive functioning were included as covariates in the multivariable models. These were age, age squared, educational attainment, gender, marital status, and chronic health conditions. *Age:* Age was included as a continuous variable. A quadratic term for age was also included in the regression models to account for non-linear differences in cognition according to age. *Education:* For descriptive analysis we included years of education as a continuous variable. For the regression analyses participants were grouped into three categories: (1) less than high school; (2) high school; and

(3) more than high school. *Gender*: dichotomous variable (women = 1). *Race/Ethnicity*: dichotomous variables measuring NHW (reference category), non-Hispanic blacks (NHB), other race (Asian, Pacific Islander or Native American), Mexicans, Cubans, Puerto Ricans, and other Hispanics. Respondents who refused to provide a race/ethnicity were considered missing for the analysis (30 cases). *Marital Status*: dichotomous variable (married or living in a consensual union = 1). *Chronic conditions*: four dichotomous variables indicating if the respondent has been ever diagnosed with hypertension, diabetes, heart condition, or stroke (yes = 1).

Statistical Analysis

Ordinary Least Squares (OLS) regression models were used to estimate the adjusted cognition scores for the three cognitive domains (verbal memory, working memory, and numeracy). The raw scores for each cognitive domain were transformed into z-scores based on the sample mean and standard deviation. This was done to account for differences in the range of possible scores on each task when making comparisons across the different cognitive domains. The multivariable models were used to estimate the marginal effects of educational attainment on scores for each cognitive domain according to race and ethnicity. All analyses were conducted using STATA/SE version 13.1 (StataCorp, 2013).

Results

Sample Characteristics

Table 1 presents the baseline descriptive characteristics of the final sample stratified by race and ethnicity. Cubans were the oldest on average (68.1 years) and were nearly 8 years older than respondents of other races (60.9 years), other Hispanic origin (60.9 years), 3 years older than NHW (65.0 years), and nearly 6 years older than NHB. On average, NHW and other races had 13.5 years of schooling while NHB were about a year below with 12.6 years of education.

Cubans and Puerto Ricans completed approximately 2 fewer years of education compared to NHW (11.1 and 11.5 years, respectively). Mexicans were the least educated and on average completed 9.1 years of education.

NHW had the highest average scores for total cognition (16.3 points) followed by other races (15.0) and other Hispanics (14.1). Puerto Ricans had the lowest total cognition with an average score of 13.1 points, which was followed by NHB at 13.3 points. All other race and ethnic groups scored approximately 3 points lower than NHW for total cognition. NHW also had the highest average scores for each cognitive domain. Puerto Ricans scored the lowest on the immediate and delayed verbal recall assessments. On average, NHW had nearly 4 correct responses on the Serial 7's task whereas NHB and Puerto Ricans scored the lowest with fewer than three correct responses on average. All race and ethnic groups had similar scores in the counting backwards assessment and no race or ethnic group had an average below 1.7 points out of a possible 2 points.

Mexicans had the highest prevalence of diabetes (36.7%) whereas NHW had the lowest prevalence at 18.1%. The prevalence of hypertension was above 50% for all race and ethnic groups, but NHB had the highest prevalence at 71.7%. NHW had the highest prevalence of heart disease at 22.8% and NHB had the highest prevalence of stroke at 9.5%.

[TABLE 1 AROUND HERE]

Race and Ethnic Differences for verbal memory, working memory, and numeracy

Table 2 shows the OLS results estimating the z-scores for verbal memory, working memory, and numeracy. Age and age-squared were significantly associated with all three cognitive domains. Being female was associated with significantly higher scores on verbal memory but significantly lower scores for working memory. Males and females did not have

significantly different mean z-scores for numeracy. Being married was associated with significantly higher mean z-scores for verbal memory and working memory but not for numeracy. Stroke was associated with significantly lower mean z-scores for all three cognitive domains, whereas diabetes and hypertension were associated with significantly lower mean z-scores for verbal memory and working memory. Self-reported heart conditions were only associated with significantly lower mean z-scores for verbal memory.

The effect of education varied between verbal memory, working memory, and numeracy. Having a high school degree or more than a high school degree had the greater effects on verbal memory and working memory compared to numeracy. Subjects with a high school degree were, on average, 0.48 SD higher for working memory, 0.34 SD higher for verbal memory, and 0.24 SD higher for numeracy when compared to subjects with less than a high school education. Subjects with more than a high school degree were 0.64 SD higher on verbal memory, 0.77 SD higher for working memory, and 0.31 SD for numeracy compared to subjects with less than a high school education. The differences between subjects with a high school degree and those with more than a high school degree were significantly different for verbal memory and working memory, but not for numeracy.

In general NHW had significantly higher mean z-scores for verbal memory, working memory, and numeracy compared to the other race and ethnic groups. An exception was for Cubans, which had significantly lower scores for working memory compared to NHW but not for verbal memory or numeracy. Puerto Ricans had the greatest disparities in cognition and were -0.54, -0.72, and -0.37 SD lower on verbal memory, working memory, and numeracy, respectively, compared to NHW. NHB had significantly lower z-scores for verbal memory,

working memory, and numeracy compared to NHW. Additionally, NHB had significantly lower scores for verbal memory and working memory compared to Mexicans and Cubans.

[TABLE 2 AROUND HERE]

Marginal effect of educational attainment on cognition according to race and ethnicity

The marginal effects of educational attainment on verbal memory, working memory, and numeracy according to race and ethnicity are presented in Figures 1-3, respectively. These figures further demonstrate the influence of education, race, and ethnicity on functioning within specific cognitive domains. Scores for the three cognitive domains increased with greater educational attainment for each race and ethnic group. NHW had the highest mean z scores on for all educational categories, whereas Puerto Ricans had the lowest mean z scores, which was followed by NHB. NHW had significantly higher scores for all three cognitive domains at each level of education compared to NHB and the Hispanic subpopulations. However, Cubans did not have significantly different scores to NHW for verbal memory (Figure 1) and numeracy (Figure 3) at each level of education. The greatest disparities between NHW and NHB were for working memory (Figure 2) and NHW scored over 0.5 SD higher, on average, than NHB at each level of education. Additionally, Mexicans scored approximately 0.25 SD higher than NHB at each level of education for working memory. Education had the smallest influence on numeracy (Figure 3) and NHW were the only group in which subjects with more than a high school education had significantly higher scores for numeracy compared to subjects with a high school education.

Figures 1-3 also show significant differences for verbal memory, working memory, and numeracy within the Hispanic subpopulations. Puerto Ricans had significantly lower mean z scores for verbal memory (Figure 1) and working memory (Figure 2) compared to Cubans, Mexicans, and other Hispanics. Puerto Ricans also had significantly lower mean z scores for

numeracy compared to Mexicans (Figure 3). Cubans had the highest mean z scores for all three cognitive domains, but the low number of Cubans in the final sample resulted in wide confidence intervals.

Discussion

The present analysis detected significant differences in verbal memory, working memory, and numeracy according to race, ethnicity, and Hispanic subpopulation. NHW had significantly higher scores for verbal memory, working memory, and numeracy compared to NHB for each level of education. These results are consistent with prior research that has reported NHB to be at an increased risk for mild cognitive impairment (Katz et al., 2012) and dementia (Mayeda et al., 2016) compared to NHW. This study also presents new evidence on differences in cognitive functioning between NHW and Hispanic subpopulations. We observed that NHW had significantly higher scores for each cognitive domain compared to Mexicans, Puerto Ricans, and other Hispanics. NHW had significantly higher scores for working memory when compared to Cubans but not for verbal memory or numeracy. The lack of significant differences in cognition between Cubans and NHW may reflect similar levels of cognitive functioning between these two groups, but these results need to be interpreted with caution because of the small sample size of Cubans in the HRS.

In general Cubans and Mexicans had similar scores for each cognitive domain and these Hispanic subpopulations had consistently higher scores when compared to Puerto Ricans. The lower cognitive functioning for Puerto Ricans compared to the other Hispanic subpopulations was unexpected because Puerto Ricans completed an average of 11.5 years of education compared to 9.2 years for Mexicans and 11.1 years for Cubans. The results presented in Figures 1-3 revealed that the differences between Puerto Ricans, Cubans, and Mexicans for each

cognitive domain were consistent for each level of educational attainment. This provides evidence that differences in educational quality may contribute to cognitive disparities among Hispanic subpopulations and not because of differences in the years of education completed. Poor education quality contributes to lower cognition for NHB compared to NHW (Sisco et al., 2015), but to our knowledge no studies have examined the role of educational quality on cognitive functioning in old age for Hispanic subpopulations.

The importance of education on cognitive functioning is further supported by the findings that the greatest differences in cognition between the Hispanic subpopulations were for verbal memory and working memory. The results from the OLS regression indicated that education had a significantly greater effect for verbal memory and working memory compared to numeracy. The differential effects of education may be partly due to the immediate and delayed word-list recall and Serial 7s being more challenging cognitive tasks than the counting backwards task.

This study has important limitations that need to be acknowledged. First, while the 2010 observation wave of the HRS includes an over sampling of NHB and Hispanics, the sample sizes for the Hispanic subpopulations was still relatively small. This was especially true for Cubans and Puerto Ricans. This limited the statistical power to detect significant differences within the Hispanic subpopulations. Second, only one cognitive assessment was used to measure working memory (Serial 7s) and numeracy (counting backwards) and verbal memory was a combined measure of two assessments. Thus, our findings need to be validated by studies that use several different cognitive assessments with varying degrees of difficulty that measure verbal memory, working memory, and numeracy.

Despite these limitations, this study makes an important contribution to research into cognitive disparities by examining functioning in specific cognitive domains and by stratifying

Hispanics into distinct subpopulations. This revealed significant differences in cognition by Hispanic subpopulation and by cognitive domain. The results of this analysis extend the evidence from prior research that Hispanics have lower cognition compared to NHW and demonstrate the importance of accounting for country and region of origin when studying the cognitive functioning of Hispanics.

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Table 1 – Descriptive Characteristics of Americans Older than 51 Years in the Health and Retirement Study by Race/Ethnicity and Gender, 2010

Variables	Overall	White	Black	Other Races	Mexicans	Puerto Ricans	Cubans	Other Hispanics
Sociodemographic								
Age	64.1	65.0	62.4	60.9	61.5	61.0	68.1	60.9
Female (%)	53.9	53.5	57.3	51.1	53.3	55.6	53.6	57.5
Education	13.2	13.6	12.6	13.6	9.2	11.5	11.1	10.9
Marital Status (%)	65.6	67.9	44.9	67.6	71.3	60.4	53.4	64.0
Cognitive Function								
Total Cognition Score (0-27)	15.7	16.3	13.3	15.0	13.6	13.1	13.8	14.1
Immediate Verbal Recall (0-10)	5.6	5.7	5.1	5.4	5.0	4.8	5.0	5.3
Delayed Verbal Recall (0-10)	4.6	4.7	3.8	4.3	4.1	3.9	4.0	4.2
Serial 7's (0-5)	3.7	3.9	2.7	3.5	2.8	2.7	2.9	2.9
Counting Backwards (0-2)	1.9	1.9	1.7	1.8	1.8	1.7	1.8	1.8
Chronic Conditions								
Diabetes (%)	20.6	18.1	29.0	26.8	36.7	32.7	28.0	22.9
Hypertension (%)	55.6	53.5	71.7	56.2	57.1	55.6	69.0	52.6
Heart (%)	21.9	22.8	20.7	20.9	12.9	21.6	22.1	15.5
Stroke (%)	6.9	6.7	9.5	8.0	5.5	7.0	4.8	3.5
Unweighted N	18962	12430	3637	581	1310	234	111	659

Note: Weighted data and unweighted sample size totals. All three covariates are expressed as averages. Cognition refers to the total cognitive score (0-27). Standard deviations are omitted.
Source: Author's own elaboration with data from the Health and Retirement Study (2010).

Table 2 – Ordinary Least Squares Coefficients by Race/Ethnicity for Z-Scores of Verbal Memory, Working Memory, and Numeracy

Variables	Verbal Memory	Working Memory	Numeracy
Age	0.13 *** (0.12, 0.14)	0.04 *** (0.02, 0.05)	0.02 * (0.01, 0.04)
Age Squared	-0.001 *** (-0.001, -0.001)	-0.0003 *** (-0.000, -0.000)	-0.0002 ** (-0.000, -0.000)
Female	0.34 *** (0.31, 0.36)	-0.21 *** (0.23, -0.18)	0.02 (-0.01, 0.05)
Married	0.08 *** (0.05, 0.11)	0.07 *** (0.04, 0.10)	0.03 (-0.002, 0.06)
High School Degree	0.34 *** (0.30, 0.37)	0.48 *** (0.44, 0.52)	0.24 *** (0.19, 0.29)
More than High School	0.64 *** (0.60, 0.67)	0.77 *** (0.73, 0.81)	0.31 *** (0.26, 0.35)
Race/Ethnicity (Ref.: Non-Hispanic Whites)			
Non-Hispanic Blacks (NHB)	-0.38 *** (-0.42, -0.35)	-0.62 *** (-0.65, -0.58)	-0.29 *** (-0.33, -0.24)
Other Races	-0.28 *** (-0.36, -0.21)	-0.26 *** (-0.34, -0.19)	-0.18 *** (-0.26, -0.09)
Mexicans	-0.25 *** (-0.30, -0.20)	-0.40 *** (-0.46, -0.34)	-0.12 *** (-0.19, -0.05s)
Puerto Ricans	-0.54 *** (-0.65, -0.42)	-0.72 *** (-0.84, -0.59)	-0.37 *** (-0.55, -0.19)
Cubans	-0.09 (-0.25, 0.06)	-0.41 *** (-0.59, 0.24)	-0.10 (-0.30, 0.11)
Other Hispanics	-0.30 *** (-0.36, -0.23)	-0.49 *** (-0.56, -0.41)	-0.24 *** (-0.33, -0.14)
Chronic Conditions			
Diabetes	-0.07 *** (-0.09, -0.04)	-0.07 *** (-0.10, -0.04)	-0.02 (-0.06, 0.02)
Hypertension	-0.06 *** (-0.09, -0.03)	-0.06 *** (-0.09, -0.03)	-0.02 (-0.05, 0.01)
Heart Condition	-0.07 *** (-0.10, -0.04)	-0.02 (-0.04, 0.02)	-0.01 (-0.06, 0.02)
Stroke	-0.22 *** (-0.27, -0.17)	-0.19 *** (-0.24, -0.14)	-0.14 *** (-0.21, -0.08))
Constant	-3.89 *** (-4.37, -3.41)	-1.26 *** (-1.76, -0.76)	-0.82 ** (-1.41, -0.23)
Unweighted N	18,890	18,890	18,890
R^2	0.26	0.23	0.04

Note: 95% confidence intervals appear in parentheses. $^{*}p \leq .05$; $^{**}p \leq .01$; $^{***}p \leq .001$.
Source: Author's own elaboration with data from the Health and Retirement Study (2010).

Figure 1: Marginal Effects of Education on Verbal Memory According to Race and Ethnicity

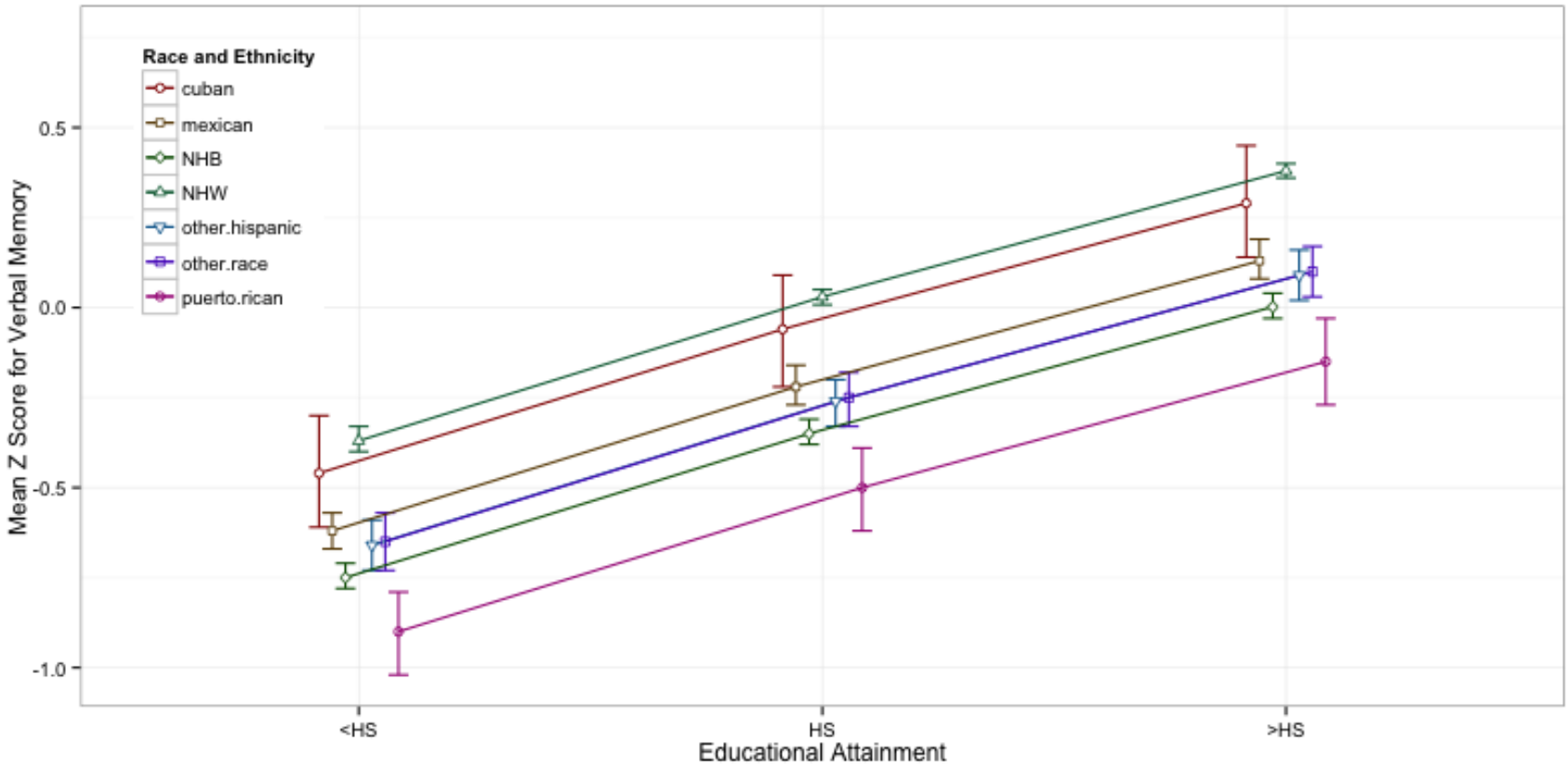

Figure 2: Marginal Effects of Education on Working Memory According to Race and Ethnicity

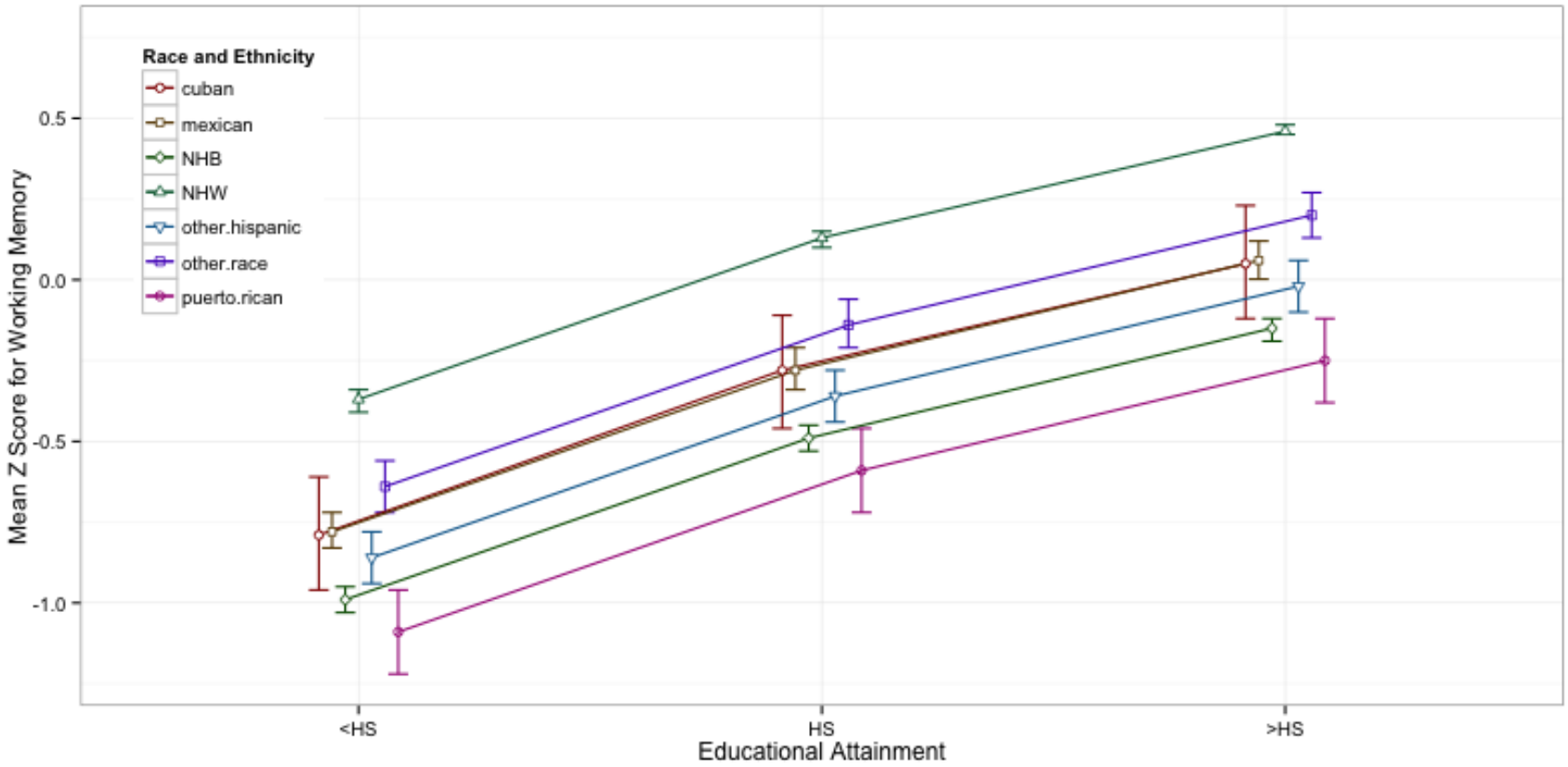

Figure 3: Marginal Effects of Education on Numeracy According to Race and Ethnicity