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OXFORD

Research Report

Stress Is Associated With Neurocognitive Function in Hispanic/Latino Adults: Results From HCHS/SOL Socio-Cultural Ancillary Study

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Abstract

Objectives: The purpose of this study was to evaluate the hypothesis that chronic and acculturative stress would be negatively associated with neurocognitive function among middle aged to older Hispanics/Latinos.

Method: Our analytic sample consisted of 3,265 participants (mean age = 56.7 (±0.24)) from the Hispanic Community Health Study/Study of Latinos who participated in its Sociocultural Ancillary Study. During the baseline phase of this project, participants were assessed on multiple domains of neurocognitive function, and completed self-report measures of chronic and acculturative stress.

Results: Each standard deviation increase in chronic stress was associated with lower performance in a verbal learning task (B = –.17, 95% CI [–.32, –.01]); this association was no longer significant after adjusting for mental and physical health symptoms, including depression and anxiety symptoms, and cardiovascular health. A standard deviation increase in acculturative stress was associated with poorer performance in all cognitive measures (Bs range = –.13 to –1.03). Associations of acculturation stress with psychomotor speed, verbal learning, and word fluency remained significant after adjusting for mental and physical health symptoms.

Discussion: Our results suggest that mental and physical health may help explain some cross-sectional associations between stress and cognition and highlight the need to examine culture-specific psychosocial stressors to better understand the context of psychosocial risk factors for neurocognitive performance.

Keywords: Acculturative stress, Cognition, Hispanic, Latino, Stress

The United States older population is increasingly becoming more diverse. Racial and ethnic minority adults have a greater risk for Alzheimer's disease and related dementias compared to non-Hispanic white adults (Ortman, Velkoff, & Hogan, 2014). The Hispanic/Latino population aged 65 years and older is projected to increase fivefold by the year 2050 (Ortman et al., 2014), yet little is known about psychosocial risk factors for reduced cognitive health within this population. Furthermore, examining predictors starting at midlife is essential given that cognitive decline may begin long before old age (Hughes, Agrigoroaei, Jeon, Bruzzese, & Lachman, 2018).

Although the association between psychosocial stress and neurocognitive function has not been examined among adult Hispanics/Latinos, substantial evidence shows that Hispanics/Latinos may be disproportionally exposed to psychosocial stress compared to non-Hispanic whites or individuals who are not of Hispanic origin. Hispanics/Latinos experience stress related to socioeconomic status (Fontenot, Semega, & Kollar, 2017), discrimination (Lee & Ahn, 2012), and for many individuals, family separation due to immigration (Cervantes, Fisher, Padilla, & Napper, 2016). Chronic exposure to stress has been shown to lead to reduced cognitive health in experimental and observational studies (Lupien, McEwen, Gunnar, & Heim, 2009). However, most of the literature on stress and cognition has been carried out primarily among non-Hispanic whites and it remains unclear whether stress functions similarly as a risk factor for reduced neurocognitive function among Hispanics/Latinos. It is likely that the wear-and-tear of the psychological and physiological sequela of chronic stress makes Hispanics/Latinos more vulnerable to reduced neurocognitive function (McEwen, 1998).

Experiences of stress activate a cascade of affective and physiological responses that are detrimental for neurocognitive function over the long term if chronic or consistent (e.g., Lupien et al., 2009). Chronic stress is associated with increased symptoms of depression (Kendler, Karkowski, & Prescott, 1999) and anxiety (Hovey & Magaña, 2000) that are, in turn, associated with reduced cognitive function and cognitive decline (Bäckman, Hill, & Forsell, 1996; Eysenck, Derakshan, Santos, & Calvo, 2007). Among Hispanics/Latinos, depression symptoms and anxious depression have been associated with lower cognitive performance (Camacho et al., 2018; Gonzalez et al., 2015). Chronic stress, in this group, is also linked with physical health outcomes, such as hypertension and diabetes (Gallo, Roesch, et al., 2014), and these physical health outcomes have been shown to predict poorer cognitive health (Jurado et al., 2017). Therefore, we planned to evaluate the association between chronic stress and neurocognitive function independent of symptoms of depression and anxiety, and physical health.

Acculturative stress among Hispanic/Latinos in the United States refers to the psychosocial strain experienced as a result of acculturation: the process of adapting to cultural norms that differ from one's own (Cervantes et al., 2016). Acculturative stress differs from traditional measures of stress as it captures strain perceived to be related to Hispanic/Latino background and immigration experiences (e.g., discrimination stress, occupational stress). Acculturative stress is associated with poorer mental and physical health (Caplan, 2007; Gallo, Penedo, Espinosa de los Monteros, & Arguelles, 2009), but no study has examined its association with neurocognitive function. Therefore, a final objective was to evaluate the association between acculturative stress and neurocognitive function in Hispanic/Latino adults.

This study addresses gaps in the literature by examining associations between chronic and acculturative stress and neurocognitive function in Hispanic/Latino adults. Based on the reviewed literature, we predicted that (a) chronic stress and (b) acculturative stress would be negatively associated with neurocognitive function in Hispanic/Latino adults. We predicted that these associations would be attenuated after controlling for depression and anxiety symptoms, and physical health.

Method

Participants and Procedure

We used data from the HCHS/SOL and HCHS/SOL Sociocultural Ancillary Study (SCAS; Gallo, Penedo, et al., 2014). HCHS/SOL is a prospective study that enrolled 16,415 individuals who self-identified as Hispanic/Latino across four field centers in the United States (Bronx, NY; Chicago, IL; Miami, FL; San Diego, CA). HCHS/SOL implemented a two-stage area household probability design (LaVange et al., 2010). The target population was all noninstitutionalized Hispanic/Latino adults aged 18–74 years in the four designated areas. During the baseline examination, participants provided demographic information and were tested in their preferred language (i.e., Spanish or English). Participants aged 45 and older also completed a neurocognitive battery provided in a face-to-face interview with trained interviewers (Gonzalez et al., 2015; Sorlie et al., 2010).

HCHS/SOL cohort members who agreed to participate in the SCAS substudy were asked to return within 3–9 months (M = 3.50, SD = 1.90) after their baseline examination to complete psychosocial assessments that included the stress measures used in the current analysis. The current analyses include data from SCAS participants who also provided baseline neurocognitive data from HCHS/SOL. Questionnaires were administered via interview using a standardized approach across all centers. The parent study and SCAS were both conducted with Institutional Review Board approval from all sites.

Materials

Chronic stress

Participants completed the eight-item chronic burden scale where participants indicated the presence of ongoing stressors in major life domains (e.g., health, job, financial, relationship, network problems), whether the stressor has been ongoing for 6 months or more, and the severity of the stressor. To indicate severity of the stressor, participants reported on a three-point scale if the event was "Not very stressful", "Moderately stressful", or "Very stressful". A total count score was calculated for the stressors endorsed as ongoing for 6 months and were reported as being moderately or very stressful (Bromberger & Matthews, 1996).

Acculturative stress

Participants completed the 17-item Hispanic Stress Inventory (Cervantes, Padilla, & De Snyder, 1990), which asked participants to indicate whether (i.e., yes, no) various situations occurred during the last 3 months. Sample items include "Because I am Latino I have had difficulty finding the type of work I want" and "Because of my poor English others have treated me badly." After each yes/no response, participants indicated how much they have felt "worried or tense" about it on a 5-point scale from "Not at all worried/tense" (1) to "Extremely worried/tense" (5). If participant endorsed any of the items, a total stress score was calculated by adding the scores from the 5-point, worried/tense Likert scale; participants received a score of 0 if they did not endorse any of the items.

Neurocognitive outcomes

Neurocognitive measures were administered by trained interviewers in the following fixed order: verbal learning and memory, word fluency, and psychomotor speed.

Verbal learning and memory

The Brief-Spanish English Verbal Learning Test (B-SEVLT) was used to assess episodic verbal learning and memory (González, Mungas, & Haan, 2002). During this task, the interviewer read a list of 15 words and asked the participant to recall as many words as possible over three learning trials. The interviewer then read a distractor list and asked the participant to recall this list. For the last and fifth trial, the interviewer asked the participant to recall the list of words that was presented initially (memory trial). A total sum score of number of words correctly recalled for the first three trials was calculated for the verbal learning score (range: 6–40) and a total score of correctly recalled words was calculated for the fifth trial for a memory score where greater scores indicated better performance (range: 0–15).

Word fluency

During the Word Fluency Test (Lezak, Howieson, Loring, & Fischer, 2004), participants were asked to produce as many words as possible that begin with the letter F and A within a time limit of 60 s for each letter whereas avoiding proper nouns, variations, plurals, and repetitions. A total sum score of admissible words produced by the participant was created were higher scores indicate more words produced. Scores ranged from 0 to 45.

Psychomotor speed

The Digit Symbol Substitution Test (Wechsler, 1981) was used in which participants were asked to transcribe numbers (1–9) to symbols using a key provided at the top of the form. Scoring of this task consisted of assigning one correct point for every symbol. Scores ranged from 0 to 83.

Table 1 Weighted Sample Demographics and Stress Scores

	Mean (SE)/Freq (%)
Sex	
Women	1,996 (56.6)
Men	1,138 (43.4)
Age (years)	56.7 (0.24)
Hispanic/Latino Background	
Dominican	305 (10.1)
Central American	306 (6.4)
Cuban	525 (28.0)
Mexican	1,152 (29.7)
Puerto Rican	557 (18.4)
South American	236 (6.1)
Language preference	
Spanish	2,733 (85.4)
English	401 (14.6)
Educational attainment	
Less than high school	1,267 (39.4)
High school education	677 (20.4)
Some college or more	1,182 (40.2)
Household income	
<$30,000	2,205 (69.7)
$30,000 or more	768 (24.4)
Missing	161 (5.9)
Nativity	
Foreign born	2,822 (90.4)
Born in the U.S. mainland	309 (9.6)
Center	
Bronx	747 (27.7)
Chicago	792 (12.5)
Miami	841 (37.4)
San Diego	754 (22.4)
Chronic stress	1.4 (0.1)[a]
Acculturative stress	12.9 (0.4)[b]

Note: Continuous variables are expressed as mean (SE), factors are expressed as counts (%).
[a]Possible range: 0–8.
[b]Possible range: 0–85.

Covariates

The following demographic characteristics were included as covariates: age, sex, Hispanic/Latino background, household income, education, participant language of preference, nativity, and study site. We adjusted for cardiovascular factors by controlling for the presence (Y/N) of hypertension, coronary heart disease/angina, stroke/transient ischemic attack, diabetes, and heart failure. We also included body mass index classification (i.e., normal, underweight, overweight, and obese) as a covariate. We adjusted for depressive and anxiety symptoms via a sum score from the Center for Epidemiological Studies for Depression (CES-D) 10-item scale (Andresen, Malmgren, Carter, & Patrick, 1994) and a sum score from the 10-item Spielberger Trait Anxiety Inventory (Spielberger, Sydeman, Owen, & Marsh, 1999), respectively.

Analytic Strategy

There were 3,265 individuals who participated in the SCAS and had neurocognitive test data. One-hundred and thirty-one (4%) participants had three or more errors on a Six-Item Screener (Callahan, Unverzagt, Hui, Perkins, & Hendrie, 2002) and were excluded from the analyses due to possible cognitive impairment (Callahan et al., 2002), resulting in an analytic sample size of 3,134 individuals. We applied sampling weights to all analyses to account for design features (see LaVange et al., 2010 for more details). Chronic stress and acculturative stress measures were z-score transformed to a mean of zero and standard deviation of one to facilitate comparison across both measures. We first generated descriptive statistics to characterize the analytic sample (Table 1) followed by linear regressions to independently evaluate associations between chronic and acculturative stress and each cognitive test (Tables 2 and 3). Lastly, we fit adjusted models for each cognitive domain to evaluate these associations after accounting for physical and mental health (final adjusted model presented in Supplementary Tables 1 and 2).

Results

Participants were 56.7 years old on average (*SE* = 0.24; range 44–74); 1,996 (56.6%) women and 1,138 (43.4%) men. See Table 1 for a more detailed description of the sample. The weighted correlation between the chronic stress and acculturative stress measure was 0.27. Results from linear regression models evaluating the associations between chronic stress and acculturative stress and neurocognitive tasks adjusting for sociodemographic variables are presented in Tables 2 and 3. The coefficients represent the change in cognitive test score for each standard deviation increase in the measure of stress. Chronic stress was negatively associated with verbal learning (*B* = –.27,

Table 2 Estimated Associations between Chronic Stress and Neurocognitive Function Accounting for Demographics

	Psychomotor speed	Verbal learning	Verbal memory	Word fluency
	B [95% CI]	*B* [95% CI]	*B* [95% CI]	*B* [95% CI]
N	2,849	2,905	2,907	2,890
Intercept	77.54 [73.65, 81.42]	34.10 [31.95, 36.25]	14.01 [12.93, 15.09]	25.85 [22.87, 28.82]
Chronic stress	–0.35 [–0.93, 0.23]	–0.27 [–0.53, –0.01]	–0.08 [–0.22, 0.05]	0.25 [–0.14, 0.65]
Age	–0.46 [–0.52, –0.40]	–0.16 [–0.19, –0.13]	–0.08 [–0.09, –0.06]	–0.02 [–0.07, 0.03]
Gender (ref = male)	2.47 [1.50, 3.44]	2.09 [1.56, 2.62]	0.93 [0.67, 1.19]	0.35 [–0.46, 1.15]
Hispanic/Latino background (ref = Mexican)	<.0001	0.0089	<.0001	<.0001
Dominican	–6.44 [–9.03, –3.86]	–0.86 [–2.29, 0.57]	–1.03 [–1.71, –0.35]	–3.09 [–6.21, 0.02]
Central American	–4.56 [–7.08, –2.04]	–0.58 [–1.85, 0.68]	–0.34 [–0.91, 0.23]	–1.85 [–4.23, 0.53]
Cuban	–1.45 [–4.07, 1.18]	–1.25 [–2.60, 0.10]	–0.84 [–1.43, –0.25]	–3.31 [–5.75, –0.86]
Puerto Rican	–0.43 [–2.80, 1.94]	–1.63 [–2.81, –0.44]	–1.46 [–2.06, –0.86]	–1.94 [–4.56, 0.67]
South American	0.37 [–2.35, 3.10]	–0.19 [–1.55, 1.17]	–0.13 [–0.76, 0.49]	–0.19 [–2.67, 2.29]
Income (ref = $30K or more)	<.0001	0.0001	<.0001	0.0006
<$30K	–3.80 [–5.04, –2.56]	–1.25 [–1.83, –0.66]	–0.73 [–1.02, –0.43]	–1.80 [–3.01, –0.60]
Missing	–7.35 [–9.72, –4.98]	–1.67 [–2.99, –0.35]	–1.05 [–1.69, –0.40]	–3.18 [–4.83, –1.53]
Education (ref = more than H.S.)	<.0001	<.0001	<.0001	<.0001
less than 9th grade	–11.8 [–13.2, –10.4]	–3.73 [–4.49, –2.97]	–1.47 [–1.82, –1.11]	–6.21 [–7.33, –5.09]
some high school	–6.25 [–8.01, –4.49]	–3.19 [–3.97, –2.41]	–1.17 [–1.57, –0.77]	–2.99 [–4.78, –1.21]
high school	–4.91 [–6.20, –3.62]	–2.49 [–3.05, –1.93]	–1.09 [–1.42, –0.76]	–3.16 [–4.10, –2.23]
Language (ref = English)	–5.82 [–7.67, –3.97]	–0.43 [–1.30, 0.43]	–0.41 [–0.87, 0.04]	–0.39 [–2.95, 2.17]
Nativity (ref = born in U.S. mainland)	–2.27 [–4.29, –0.25]	0.97 [0.17, 1.76]	0.45 [0.01, 0.89]	0.58 [–1.87, 3.02]
Center (ref = San Diego)	0.0001	0.34	0.0224	0.05
Bronx	–3.70 [–6.26, –1.14]	–0.57 [–2.09, 0.96]	–0.40 [–1.10, 0.31]	–1.32 [–4.43, 1.78]
Chicago	–3.77 [–5.49, –2.06]	–0.23 [–1.24, 0.78]	0.21 [–0.26, 0.67]	–1.54 [–2.98, –0.11]
Miami	–2.45 [–4.94, 0.05]	–1.12 [–2.60, 0.37]	–0.35 [–1.00, 0.31]	–0.78 [–3.31, 1.75]

Table 3 Estimated Associations between Acculturative Stress and Neurocognitive Function Accounting for Demographics

	Psychomotor speed	Verbal learning	Verbal memory	Word fluency
	B [95% CI]	*B* [95% CI]	*B* [95% CI]	*B* [95% CI]
N	3,039	3,095	3,097	3,080
Intercept	77.84 [73.77, 81.90]	33.87 [31.82, 35.92]	13.80 [12.76, 14.84]	26.20 [23.27, 29.13]
Hispanic Stress Inventory	−1.03 [−1.57, −0.50]	−0.40 [−0.67, −0.14]	−0.13 [−0.26, −0.01]	−0.54 [−0.98, −0.10]
Age	−0.48 [−0.54, −0.42]	−0.16 [−0.20, −0.13]	−0.08 [−0.09, −0.06]	−0.03 [−0.09, 0.02]
Gender (ref = male)	2.36 [1.44, 3.28]	2.15 [1.65, 2.65]	0.97 [0.72, 1.22]	0.34 [−0.44, 1.12]
Hispanic/Latino background (ref = Mexican)	<.0001	0.0026	<.0001	<.0001
Dominican	−6.30 [−8.61, −4.00]	−0.59 [−1.85, 0.67]	−0.90 [−1.52, −0.27]	−3.16 [−6.13, −0.20]
Central American	−4.42 [−6.68, −2.15]	−0.39 [−1.49, 0.71]	−0.24 [−0.76, 0.28]	−1.84 [−4.04, 0.36]
Cuban	−1.36 [−3.68, 0.95]	−1.08 [−2.33, 0.18]	−0.64 [−1.19, −0.09]	−3.24 [−5.50, −0.98]
Puerto Rican	−0.58 [−2.67, 1.52]	−1.67 [−2.71, −0.64]	−1.47 [−2.01, −0.93]	−2.16 [−4.60, 0.28]
South American	0.18 [−2.28, 2.64]	−0.11 [−1.31, 1.09]	−0.06 [−0.62, 0.51]	−0.32 [−2.61, 1.98]
Income (ref = $30K or more)	<.0001	<.0001	<.0001	0.0006
<$30K	−3.54 [−4.70, −2.39]	−1.28 [−1.81, −0.74]	−0.73 [−1.01, −0.45]	−1.52 [−2.64, −0.40]
Missing	−6.99 [−9.21, −4.76]	−1.78 [−2.97, −0.58]	−1.16 [−1.76, −0.56]	−2.98 [−4.49, −1.46]
Education (ref = more than H.S.)	<.0001	<.0001	<.0001	<.0001
less than 9th grade	−11.7 [−12.9, −10.4]	−3.61 [−4.32, −2.89]	−1.42 [−1.76, −1.09]	−6.25 [−7.31, −5.19]
some high school	−6.06 [−7.77, −4.35]	−3.10 [−3.85, −2.36]	−1.12 [−1.51, −0.73]	−2.94 [−4.63, −1.25]
high school	−5.03 [−6.23, −3.82]	−2.37 [−2.92, −1.81]	−1.01 [−1.34, −0.69]	−−3.11 [−3.99, −2.24]
Language (ref = English)	−5.39 [−7.14, −3.64]	−0.17 [−1.04, 0.70]	−0.34 [−0.79, 0.11]	−0.38 [−2.81, 2.05]
Nativity (ref = born in U.S. mainland)	−2.04 [−3.98, −0.10]	1.10 [0.28, 1.91]	0.47 [0.04, 0.90]	0.58 [−1.84, 2.99]
Center (ref = San Diego)	<.0001	0.18	0.0037	0.17
Bronx	−3.68 [−5.93, −1.42]	−0.69 [−2.03, 0.66]	−0.45 [−1.10, 0.20]	−1.11 [−4.11, 1.89]
Chicago	−3.76 [−5.33, −2.20]	−0.20 [−1.13, 0.74]	0.17 [−0.27, 0.61]	−1.26 [−2.71, 0.20]
Miami	−2.23 [−4.52, 0.05]	−1.25 [−2.60, 0.11]	−0.47 [−1.08, 0.15]	−0.61 [−2.99, 1.78]

95% CI [−.53, −.01]) though this association did not remain significant after adjusting for physical and mental health variables (see Supplementary Table 2). As given in Table 3, acculturative stress was negatively associated with all neurocognitive tasks (*B*s range = −.40 to −1.03; 95% intervals did not cross zero). The associations between acculturative stress and psychomotor speed (*B* = −0.92, 95% CI [−1.47, −.02]), verbal learning (*B* = −0.57, 95% CI [−1.08, −0.07]) and word fluency (*B* = −.04, 95% CI [−.08, −.01]) remained statistically significant after accounting for physical and mental health, whereas verbal memory did not (see Supplementary Table 3).

Discussion

We found that accounting for relevant demographics, greater levels of chronic stress were associated with poorer performance in tasks of verbal learning and that acculturative stress was related to reduced performance in tasks of psychomotor speed, verbal learning and memory, and word fluency. However, the association between chronic stress and verbal learning and acculturative stress and verbal memory were no longer significant after accounting for mental and physical health. These findings are consistent with studies showing that the deleterious effects of chronic stress on neurocognitive health outcomes may be due to the emotional and physical health consequences of stress (Lupien et al., 2009; McEwen, 1998).

Notably, only the association between acculturative stress and verbal memory was reduced significantly after accounting for mental and physical health indicators. The associations between acculturative stress and psychomotor speed, verbal learning, and word fluency were robust to physical and mental health, and to other demographic covariates. Differential associations of chronic stress and acculturative stress with cognitive performance merit discussion. The correlation between chronic stress and acculturative stress was *r* = .27 showing that although there is some overlap between the two, acculturative stress captures unique variance and aspects of stress. Thus, stressors perceived to result from the process of adapting to a culture that differs from one's own among Hispanic/Latino adults, may have unique associations with specific cognitive domains. The negative association between acculturative stress and psychomotor speed might be because psychological distress resulting from these experiences diminishes attentional resources needed to efficiently complete the tasks at hand (e.g., Stawski, Sliwinski, & Smyth, 2006). Verbal abilities tend to remain relatively stable throughout adulthood (e.g., Christensen, 2001) with deficits in word fluency and verbal learning related to neuropathological outcomes (Taler & Phillips, 2008). The negative association between

acculturative stress and verbal aspects of functioning is therefore notable and warrants additional investigation.

One important limitation is that these are cross-sectional analyses and we cannot infer temporal ordering. Based solely on these results, it is unclear whether indicators of physical and mental health are in the causal pathway (mediators), are confounders outside the causal pathway, or are themselves representative of chronic stress. Future longitudinal follow-up of HCHS/SOL participants will enable us to examine dynamic changes in stress domains and how they might contribute to physical and mental health outcomes, or vice versa.

With the aging of the Hispanic/Latino population, it is imperative to develop a better understanding of modifiable risk factors for reduced cognitive health in this sector of the population. This is among the first studies to show that chronic and acculturative stress may be relevant risk factors for poorer cognitive health among adult Hispanics/Latinos. Consistent with recent contentions of the need to consider the contexts in which hypothesized risk factors operate (Brewster et al., 2019), we show that for Hispanics/Latinos, stressors related to adapting to a different culture may be an additional factor to be considered in research on psychosocial correlates of cognitive health.

Supplementary Material

Supplementary data are available at The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences online.

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Conflicts of Interest

None declared.

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