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Vascular risk and depression in the Hispanic Established Population for the Epidemiologic Study of the Elderly (EPESE)

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SUMMARY

Objective—Although vascular depression has received considerable research attention, relatively little research in this area has focused on minority samples. This study investigated the association between baseline vascular risk factors (VRFs) and risk for elevated depressive symptoms at 2-year follow-up in a sample of 964 individuals without significant depressive symptomatology (CES-D < 12) or cognitive impairment (MMSE < 24) at baseline from the Hispanic Established Population for the Epidemiologic Study of the Elderly.

Methods—We examined the associations between self-reported baseline vascular risk factors (chest pain, heart attack, stroke, hypertension, diabetes, and smoking) and a composite of these risk factors with elevated depressive symptoms (CES-D ≥ 16) at 2-year follow-up.

Results—Seventy-four (7.7%) of the 964 participants without evidence of depression at baseline demonstrated elevated depressive symptoms (CESD ≥ 16) 2 years later. There was an overall pattern of higher rates of elevated depressive symptoms at 2-year follow-up with increasing number of vascular risk factors (0 VRFs = 6.4%, 1 VRF = 5.5%, 2 VRFs = 7.7%, and 3 or more VRFs = 14.7%). After controlling for demographic variables, physical functioning, and other medical conditions, the cumulative vascular risk index was significantly associated with elevated depressive symptoms at 2-year follow-up ($p < 0.05$).

Conclusions—Our results suggest vascular conditions may contribute to risk for depression over time among Mexican American elders, and this is relatively independent of other medical conditions. These findings suggest that depression is an additional long-term complication of these common cardiovascular disorders.

Keywords

vascular depression; geriatric depression; minority elders; Hispanic elders; Mexican American elders

INTRODUCTION

The vascular depression hypothesis argues that vascular disease can contribute to the development of depression in late life (Alexopoulos et al., 1997). The prevalence of cerebrovascular risk factors (CVRFs) increases with age and leads to greater white matter

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CONFLICT OF INTEREST

None known.

hyperintensities (WMHs) and other cerebrovascular changes in depressed elders when compared to age-matched non-depressed controls, specifically in the subcortical and frontal areas of the brain (Alexopoulos et al., 1997; Krishnan et al., 1997; Lyness et al., 1998; Steffens et al., 1999; Campbell and Coffey, 2001; Krishnan et al., 2004). Studies examining the link between CVRFs and depression have also generated substantial research attention (Lyness et al., 1998, 2000; Mast et al., 2004, 2008).

Unfortunately, the majority of this research has used primarily Caucasian subjects and to date, there has been little research investigating the vascular depression hypothesis in minority samples. This is problematic given the sharp growth of minority elders projected in the US population. Two recent studies examined the vascular depression hypothesis in samples with large numbers of minority elders, and found that high rates of cerebrovascular risk factors were significantly associated with higher rates of depressive symptomatology in both Black and White elders (Azar et al., 2005; Mast et al., 2008).

The lack of vascular depression research is apparent among Hispanic elders who represent the fastest growing segment of older adults in the United States. Whereas the non-Hispanic White population age 65 and older is expected to grow by 116.7% from 2000 to 2050, the Hispanic elder population is expected to increase by 764%, which is by far the greatest increase among all ethnic groups in the United States (Min, 2005). Specifically, Mexican Americans represent the fastest growing segment of the US Hispanic population 65 and older (Schneider and Chiriboga, 2005).

Although results are mixed (Schneider, 2004), some researchers have found greater vascular burden among Hispanic Americans. Cardiovascular disease may be 'the leading cause of mortality for Hispanics, who have a higher prevalence of risk factors for cardiovascular disease, such as diabetes mellitus, obesity, and hyperlipidemia (Bassford, 1995).' Some research also suggests that Mexican-Americans report greater depressive symptomatology compared to non-Hispanic Whites and African Americans (Black et al., 1998; Gonzalez et al., 2001; Schneider and Chiriboga, 2005).

In this study, we investigated whether prevalent vascular risk factors (VRFs) contributed to greater risk for elevated depressive symptoms among community dwelling elder Mexican Americans. It was hypothesized that among Mexican American elders with no evidence of significant depressive symptomatology or cognitive impairment at baseline, those with a greater number of VRFs would show increased risk for elevated depressive symptoms (CESD ≥ 16) at 2-year follow-up, compared to older adults with fewer baseline VRFs. We further hypothesized that a significant relationship between VRFs and depression would remain independent of demographic variables, physical functioning, and chronic comorbid medical conditions.

METHODS

Sample

The Hispanic Established Population for the Epidemiologic Study of the Elderly (HEPESE) is the first large-scale, population based study of Mexican American elders to provide estimates on the prevalence of physical and mental health conditions, as well as functional impairments in this population (Black et al., 1998; Black and Markides, 1999; Chiriboga et al., 2002). Detailed characteristics of the HEPESE sample have been described elsewhere (Black et al., 1998). However, the demographic and clinical characteristics of the final sample used in the current study can be found in Table 1. Analyses for the current study were conducted using a subset of data from the Hispanic HEPESE which consists of 2,489

community-dwelling Mexican American Elders who completed both a baseline interview questionnaire as well as a 2-year follow-up interview.

The main analyses in this study were concerned with detecting new cases of significant depressive symptomatology (CES-D ≥ 16), and therefore, the analyses presented here reflect only a subset of the larger sample. These analyses include 964 individuals without significant depressive symptomatology (CES-D < 12 , i.e. 0.5 SD below the cut-score of 16) or cognitive impairment (MMSE > 24) at baseline and who completed the 2-year follow-up interview.

Measures

Depressive symptoms. Depressive symptoms were measured with the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977), which was developed to help identify depressive symptoms in the general population and is the most widely used depression scale in studies with older adults (Black et al., 1998). This scale has been shown to be highly valid and reliable when used with community dwelling elders (Beekman et al., 1997; Lewinsohn et al., 1997). The CES-D consists of 20 items measured on a four-point frequency scale, with potential scores ranging from 0–60. Higher scores indicate greater levels of depressive symptoms. Previous studies using these data have utilized a CES-D score ≥ 16 as a dichotomous measure of depressive symptoms (Black et al., 1998).

Prevalent vascular disease and associated conditions

Vascular disease prevalence was determined from a series of items that asked participants about a number of chronic health conditions. The question stem for four of the vascular conditions in this study (heart attack, stroke, hypertension, and diabetes) was: ‘Has a doctor ever told you that you had/have...?’. The question stem for chest pain was ‘Have you ever had pain or discomfort in your chest?’. The question stem for smoking was ‘Have you ever smoked at least 100 cigarettes in your entire life?’. The vascular conditions utilized in this study were selected due to their associated risk in the development of cerebrovascular disease (Sacco et al., 1997; Tonstad and Johnston, 2006). Moreover, these vascular risk factors have also been associated with comorbid depressive symptoms (Kales et al., 2005). A composite of the vascular risk factors listed above was used to construct a cumulative vascular risk index in order to test the impact of overall vascular burden on depression over time. Individual vascular conditions were recoded into dichotomous variables, a score of ‘1’ indicating presence, ‘0’ indicating absence at baseline. These were then summed into an overall composite index score with a potential range of 0–6.

Covariates—To account for potential confounding variables, we controlled for demographic variables, other medical conditions, and physical functioning that might be associated with depressive symptoms (Lyness et al., 1998, 2000; Lenze et al., 2001).

Demographics—Demographic characteristics included age, sex, education (0, 1–5, 6–8, 9–12, 13–16, 17–20 years of education), and annual household income (\$0–19,999, \$20,000–39,999, \$40,000 and above).

Other medical conditions—We constructed an overall medical burden index consisting of other non-vascular chronic medical conditions in a similar fashion as the vascular burden index. These conditions included significant breathing problems, cancer, arthritis, hip fracture, stomach ulcers, kidney disease, urinary incontinence, and bladder incontinence. Pulmonary disease, cancer, arthritis, and hip fracture have all been previously shown to predict the presence of depressive symptoms among older adults (Penninx et al., 1996; Peruzza et al., 2003; Rao and Cohen, 2004; Lenze et al., 2007). Stomach ulcers, kidney

disease, urinary and bladder incontinence were included because they have been shown to be significantly related to depression in the Hispanic EPESE sample (Black et al., 1998). The urinary incontinence, bowel incontinence, and significant breathing problems variables were missing a large number of responses, which would have significantly reduced our sample size. Therefore, we collapsed those who had missing data and those who did not report having these conditions into one category. This assumes that participants who have one of these medical conditions would, on average, report it, and those who were uncertain or did not have the condition would not have reported it. This approach allowed us to maximize sample size and statistical power when controlling for medical comorbidity. Although we coded missing responses as 'no', we also took a more conservative approach and re-estimated the logistic regression analysis excluding those with missing data. This approach did not diminish the size of the association [missing data used, Odds Ratio (OR) = 1.505; missing data coded as 'no,' OR = 1.554]. The cumulative medical burden index was constructed by coding each medical condition as '1' if present and '0' if absent at baseline. These were then summed into an overall composite index with a potential range of 0–8.

Physical functioning—Difficulty with physical functioning was determined by the total number of limitations in activities of daily living (ADL) and instrumental activities of daily living (IADL) separately at baseline. The ADLs assessed included: walking across a small room, bathing, personal grooming, dressing, eating, getting from a bed to a chair, and using a toilet (potential range of 0–7, with higher scores indicating a greater number of ADL problems). The IADLs assessed included being able to: use the telephone without help, drive a car or travel alone, go shopping for groceries/clothes, prepare own meals without help, do light housework without help, take medicine without help, handle money without help, do heavy work around the house, walk up and down stairs without help, and walk half a mile without help (potential range of 0–10, with higher scores indicating a greater number of IADL problems).

Procedures and statistical analyses

The primary purpose of this study was to investigate whether baseline individual VRFs as well as cumulative vascular risk were associated with the likelihood of developing significant depressive symptomatology (CES-D ≥ 16) at 2-year follow up. First, unadjusted odd ratios (OR) were calculated for each individual VRF at 2-year follow-up. Second, adjusted OR were estimated controlling for demographic variables and level of physical functioning. This was estimated using a logistic regression model, with demographic variables in the first block, total number of ADL and IADL difficulties comprising the second block, and cumulative vascular risk in the third block. In the final step, we repeated this analysis but included general medical comorbidity as a covariate in the third block (cumulative vascular risk now in the fourth block) of the logistic regression analysis.

RESULTS

Compared to individuals excluded from the analyses (CESD ≥ 12 or MMSE < 24 or who had incomplete depression or cognitive functioning data at baseline), the 964 individuals included in the main analyses were more likely to be male ($\chi^2 (1, n = 2438) = 22.849, p < 0.001$), were slightly younger (mean age 71.67 vs 74.01 years, $p < 0.001$), had higher levels of education ($\chi^2 (5, n = 2402) = 259.329, p < 0.001$), and had slightly greater household incomes ($\chi^2 (2, n = 2194) = 20.524, p < 0.001$). As anticipated, the individuals included in these analyses also had fewer comorbid medical conditions ($\chi^2 (5, n = 1524) = 14.007, p = 0.016$), vascular risk factors ($\chi^2 (3, n = 2020) = 7.998, p = 0.046$), ADL limitations ($\chi^2 (4, n = 2433) = 119.491, p < 0.001$) and IADL limitations ($\chi^2 (5, n = 2434) = 261.777, p <$

0.001) at baseline compared to excluded individuals. Table 1 describes the demographic and clinical characteristics of the final study sample.

Vascular conditions and elevated depressive symptoms after 2 years

Seventy-four of the 964 participants without evidence of significant depressive symptomatology at baseline demonstrated elevated depressive symptoms (CESD ≥ 16) 2 years later (7.7%). Individuals who reported chest pain or hypertension at baseline were twice as likely to demonstrate elevated depressive symptoms at follow-up (Table 2). Also, baseline diabetes was associated with a 70% increased risk for elevated depressive symptomatology at 2-year follow-up, a finding that approached statistical significance [OR = 1.7, $p = 0.06$, 95% Confidence Intervals (CI): 0.97–2.88]. Persons who reported breathing problems or arthritis were almost twice as likely to have elevated depressive symptoms at follow-up. Interestingly, individuals who reported smoking were significantly less likely to have elevated depressive symptoms at 2-year follow-up. The smoking item assessed whether respondents smoked at least 100 cigarettes in their lifetime. Therefore, it may include a number of former and less chronic smokers, whose smoking habits may not have contributed to elevated vascular risk to the same degree as chronic smokers.

Cumulative vascular risk and 2-year elevated depressive symptoms

Next, we estimated the extent to which 2-year risk for developing elevated depressive symptoms was associated with cumulative vascular risk. Due to missing data, the following analyses reflect subsamples of the original 964 participants who met our inclusion criteria. We calculated a cumulative vascular risk index and divided the sample into four groups based on the total number of VRFs each participant had at baseline (0 conditions, $n = 208$; 1 condition, $n = 338$; 2 conditions, $n = 228$; and 3 or more conditions, $n = 134$). There was an overall pattern of higher rates of significant depressive symptomatology at 2-year follow-up with increasing number of VRFs ($n = 881$) (0 VRFs = 6.8%, 1 VRF = 5.8%, 2 VRFs = 8.3%, and 3 or more VRFs = 17.2%). Table 3 displays the results from the two logistic regression models. The first model includes demographic variables, physical functioning, and the cumulative vascular risk index ($n = 806$). The second model includes the cumulative medical index as an additional covariate ($n = 801$).

After controlling for demographic variables and physical functioning, the cumulative vascular risk index was significantly associated with elevated depressive symptoms at 2-year follow-up ($p < 0.01$). Persons with three or more VRFs had the greatest risk for developing elevated depressive symptoms (adjusted OR = 2.8) when compared to those with no VRFs (reference group).

After controlling for the potential impact of other chronic medical conditions, the cumulative vascular risk index remained significantly associated with elevated depressive symptoms ($p < 0.05$). The cumulative medical index was associated with a more than 50% increased risk (OR = 1.55, $p < 0.05$, OR 95% CI 1.11–2.18) for elevated depressive symptoms at 2-year follow-up, even after controlling for demographic variables and physical functioning.

DISCUSSION

These findings provide support for the vascular depression hypothesis in a sample of Mexican American elders. Hypertension and chest pain were associated with elevated depressive symptoms at 2-year follow-up, and individuals with a greater number of VRFs at baseline were found to have an increased risk of developing significant depressive symptomatology 2-years later independent of demographic variables and physical

functioning. This effect was slightly attenuated with the addition of other chronic medical conditions (non-vascular conditions) to the model, but remained statistically significant. Although our results suggest vascular conditions may contribute to risk for incident depression among community dwelling Mexican American elders, those with greater medical comorbidity (of non-vascular conditions) were also more likely to become depressed over the 2-year follow-up.

Much of the prior research supporting the vascular depression hypothesis has utilized primarily non-Hispanic White samples. The results of the current study provide support for the association between vascular risk and the development of elevated depressive symptoms in a Mexican American sample that was not depressed at baseline. This finding is consistent with prior studies that have found significant associations between VRFs and depression in both non-Hispanic White and African-American samples. Additionally, this finding is consistent with prior studies that have found links between individual VRFs and development of depression among Mexican Americans. For example, diabetes is a specific VRF that is highly prevalent in Mexican American samples, and has been found to be associated with increased rates of depressive symptomatology (Black, 1999). In our sample, reporting diabetes at baseline was associated with a 70% increased risk for developing significant depressive symptomatology at 2-year follow-up, a finding that approached statistical significance. In a cross-sectional analysis Black (1999) found that Mexican American elders with diabetes mellitus have a higher prevalence of depression compared to Mexican American elders without this disease. Furthermore, Black et al. (2003) found an increasing risk for diverse negative health outcomes, such as mortality, in older adults with both diabetes and depression with increasing depression severity.

Limitations of the current study include the absence of a formal diagnosis of depression via a structured clinical interview. We also did not have information on participants' depression history, and therefore could not determine whether the elevated depressive symptoms observed at 2-year follow-up represent a new episode or a first episode of depression. Using the CES-D as the measure of depression in a Hispanic American sample is an additional limitation. Guarnaccia et al. (1989) conducted a factor structure of the CES-D in a Hispanic American sample and found a different factor structure compared to non-Hispanic White samples. The authors caution that CES-D results may need to be interpreted differently cross-culturally, and caution against using standard clinical cut-offs as some of the symptoms included in the CESD may not be good indicators of depression in Hispanic American samples (Guarnaccia et al., 1990).

A second limitation is that data for VRFs were collected via self-report measures. Although this can be very reliable (Bush et al., 1989), it may underestimate the prevalence of vascular problems and their link with depressive symptoms. Further, the duration of reported VRFs at baseline and information on treatment adherence are unknown. Therefore we could not test the hypothesis that long standing vascular conditions and/or poorly managed vascular conditions, are more likely to lead to significant depressive symptoms (via potential increased risk for cerebrovascular changes). A third limitation is the absence of neuroimaging data on participants to confirm cerebrovascular disease in the prefrontal and subcortical regions of the brain. Significant cerebrovascular changes in these areas would provide support for cerebrovascular lesions as the primary mechanism in the brain linking vascular disease with the development of late life depression, as opposed to other processes such as inflammation. A final limitation is that this study utilized data solely from a Mexican American sample. Previous studies have found considerable heterogeneity among Hispanic groups (e.g. Mexicans, Puerto Ricans, Cubans, and individuals from Spain, the Dominican Republic, or Spanish-speaking Central and South American countries; Alvarez et al., 2004). It is important to recognize the potential heterogeneity both across and within

Hispanic American samples as these differences may relate to prevalence of VRFs and mental health outcomes. Further, we did not investigate the potential effects of acculturation and age of migration on the relationship between VRFs and the development of depression. Alegria et al. (2007) found nativity and age of migration to be significantly related to the pattern of onset of psychological disorders in Hispanic Americans. Black, Markides, and Miller (1998) suggest that differences in immigration experiences may be important ‘factors associated with increased risk for depressive symptoms’ (p. s205), particularly among the older women in the Hispanic EPESE sample.

Despite these limitations, the findings of the current study are strengthened by the use of a large, representative sample of community-dwelling US Mexican elders to investigate the vascular depression hypothesis. Further, few studies have addressed the development of depression in initially depression free elders. The longitudinal follow-up allowed for an investigation of the development of significant levels of depressive symptomatology over time in older individuals with varying levels of baseline vascular risk. Future research should address the limitations described above in a heterogeneous sample of Hispanic elders by combining measures of vascular risk, neuroimaging, and structured interviews for depression diagnosis.

The association between vascular diseases and depressive symptoms in elder Mexican Americans has important health care implications. The significant association between depression and VRFs found in this study suggests that health care professionals monitor older Mexican Americans with these VRFs in order to increase access to treatment. Given the different rates of specific vascular diseases in different minority groups (Sundquist et al., 2001), further research on vascular depression in elderly minority samples would provide a better understanding of the association between vascular risk and depression in these groups, as well as provide further evidence linking vascular disease and depression in general. Finally, given that individuals with VRFs can be easily identified and monitored, future research should investigate strategies aimed at preventing depression in these individuals.

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Table 1

Demographic and clinical characteristics of final study sample (n = 964) baseline characteristics (1993–1994).
Hispanic Established Population for Epidemiologic Studies of the Elderly

Mean age (SD) at baseline	71.67 (5.615)
n (%)	
Sex	
Women	523 (52.6%)
Men	471 (47.4%)
Years of formal education	
0 years	66 (6.6%)
1–5 years	393 (39.5%)
6–8 years	274 (27.6%)
9–12 years	193 (19.4%)
13–16 years	52 (5.2%)
17–20 years	10 (1.0%)
Income (in US dollars)	
\$0–19,999	823 (82.8%)
\$20,000–39,999	82 (8.2%)
\$40,000 and above	11 (1.1%)
Total number of IADL limitations	
0	633 (63.7%)
1–2	236 (23.7%)
3–4	71 (7.1%)
5–6	23 (2.3%)
7–8	19 (9.3%)
9–10	9 (9%)
Total number of ADL problems	
0	955 (96.1%)
1–2	21 (2.1%)
3–4	11 (1.1%)
5–6	3 (0.3%)
7	3 (0.3%)
Number of vascular conditions	
0	208 (20.9%)
1	338 (34.0%)
2	228 (22.9%)
3 or more	134 (13.5%)
Incident elevated depressive symptoms (2-year follow-up (1995–1996))	74 (7.7%)

Table 2

Individual baseline conditions (1993–1994) and risk for significant depressive symptomatology at 2-year follow-up (1995–1996)

	OR	OR 95% CI	p-value
Vascular risk factors			
Myocardial Infarction	1.48	0.71–3.10	0.29
Stroke	0.83	0.25–2.74	0.76
Hypertension	2.3	1.39–3.70	0.001**
Diabetes	1.7	0.97–2.88	0.06
Chest Pain	2.1	1.23–3.55	0.005**
Smoking	0.60	0.36–0.99	0.04*
Comorbid medical disorders			
Urinary Incontinence	1.10	0.43–2.84	0.84
Bowel Incontinence	0.70	0.09–5.36	0.73
Kidney Disease	#	#	0.56
Stomach Ulcers	#	#	0.44
Hip Fracture	1.35	0.31–5.91	0.69
Breathing Problem	2.16	1.29–3.61	0.003**
Cancer	1.67	0.64–4.38	0.30
Arthritis	2.76	1.70–4.49	<0.001***

* p < 0.05;

** p < 0.01;

*** p < 0.001.

ORs could not be calculated because no participants with ulcer or kidney problems at baseline scored in the depressed range at follow-up.

OR = Odds Ratio; 95% CI = 95% Confidence Interval.

Table 3

Cumulative vascular risk and significant depressive symptomatology. Hispanic Established Population for Epidemiologic Studies of the Elderly (1993–1994 to 1995–1996)

	Without cumulative medical index (n = 806)			With cumulative medical index (n = 801)		
	OR	OR 95% CI	p-value	OR	OR 95% CI	p-value
Age						
Sex	1.05	0.62–1.78	0.86	1.07	0.630–1.81	
Income	3.15	1.67–5.93	>0.001***	2.63	1.38–5.03	
Education	0.47	0.15–1.50	0.22	0.40	0.12–1.30	
ADL	1.01	0.78–1.33	0.92	1.00	0.76–1.32	0.81
IADL	1.24	0.70–2.19	0.46	1.26	0.72–2.23	0.003**
Cumulative Medical Index Cumulative	1.27	0.95–1.69	0.11	1.23	0.91–1.65	0.13 0.98
Vascular Risk	—	—	—	1.55	1.11–2.18	0.42 0.15
0 VRFs (Reference)	1.512	1.15–2.00	0.003**	1.35	1.00–1.81	0.011*
Category) 1 VRF	—	—	—	—	—	0.048*
2 VRFs	0.71	0.31–1.64	0.42	0.60	0.25–1.41	—
3 or more VRFs	1.43	0.64–3.17	0.38	1.01	0.43–2.36	0.24 0.98
	2.83	1.26–6.37	0.012*	1.94	0.82–4.58	0.13

Note: OR = odds ratio; 95% CI = 95% confidence interval; VRF = vascular risk factor.

* p < .05;

** p < .01;

*** p < .001.