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Frailty Prevalence and Neighborhood Residence in Older Mexican Americans: The San Antonio Longitudinal Study of Aging

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Abstract

Objectives—to examine the association between neighborhood residence and frailty prevalence in older Mexican Americans (MAs).

Design—Cross-sectional, observational study.

Setting—Socioeconomically and ethnically diverse neighborhoods in San Antonio, Texas.

Participants—394 MA community-dwelling older adults (age 65+) who completed the baseline examination of the San Antonio Longitudinal Study of Aging (SALSA) (1992–1996).

Measurements—Subjects were randomly sampled from three types of neighborhoods that varied in ethnic composition and economic environment: barrio (low-income, exclusively MA), transitional (middle-income, equal proportion MAs and EAs) and suburban (upper-income, predominantly EA). Frailty was classified using the Fried criteria. Frailty odds by neighborhood were estimated using logistic regression, with the suburban neighborhood as the referent category. Covariates included age, sex, diseases, depressive symptoms, and cognitive function.

Results—Frailty prevalence was 15.6% in the barrio, 9.4% in the transitional neighborhood and 3.5% in the suburbs ($p = .01$). After adjusting for sociodemographics and disease covariates, odds

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of frailty were 4.15 times higher for MAs residing in the barrio vs. those residing in the suburbs ($p=.026$). After adjustment for depression and cognition, this association was no longer significant. Diabetes and depression account for the higher odds of frailty in the barrio. Although odds of frailty in the transitional neighborhood were 1.95 times higher than those in the suburbs, the odds ratio was not statistically significant.

Conclusion—Considered together, the ethnic composition and economic environment of the neighborhoods in which MA older adults reside are strongly associated with their odds of being frail.

Keywords

frailty; neighborhood; Mexican Americans

INTRODUCTION

Frailty is a geriatric syndrome of increased vulnerability to stressors which is marked by increased risk for poor health outcomes, including disability, falls, nursing home placement and death.^{1, 2} Prior studies have shown that frailty prevalence is higher in ethnic minority groups,^{3, 4} including Mexican Americans (MAs), who comprise the largest and most rapidly growing ethnic subgroup in the U.S.⁵ Neighborhood residence has been identified as an important factor that contributes to individual health and can impact cognition, affect, and mobility disability.^{6–8} Recognizing this, Healthy People 2020 has identified the creation of “social and physical environments that promote good health for all” as one of its four overarching goals.⁹ Cramm and Nieboer recently examined the association of neighborhood factors with frailty in older adults living in Rotterdam, and found that residents who reported a high sense of social cohesion and neighborhood belonging had lower odds of frailty compared to those who did not.¹⁰ In a review of frailty prevalence across several different studies of community-dwelling older adults, Collard et al. found that frailty prevalence varies greatly from 4% to 59.1%, which suggests that frailty prevalence may vary based on differing characteristics of the communities from which individuals were sampled.¹¹ To date only one published study has investigated the association between neighborhood and frailty in older MAs.¹² In this study, Aranda et al. found that, lower socioeconomic status (SES) older MAs living in high-density MA neighborhoods had lower risk of becoming frail over two years than those living in lower-density MA neighborhoods. The present study provides further insights into the association of neighborhood and frailty among older MAs, in particular, by examining frailty across three types of neighborhoods that vary in both MA composition and SES.

METHODS

Subjects

Subjects for the present report were the 394 MAs, aged 65 to 80, who participated in the baseline examination (1992–1996) of the San Antonio Longitudinal Study of Aging (SALSA), a community-based study of the disablement process in older MAs and European Americans (EAs). Detailed descriptions of the sampling design and response rates have been

published previously.^{13,14} Briefly, participants were randomly sampled from three types of neighborhoods purposively selected based on census indicators to represent distinct levels of SES and assimilation to the broader society among Mexican Americans: (1) low-income, almost exclusively MA neighborhoods, where a highly traditional MA cultural orientation predominated (barrio); (2) middle income, ethnically balanced neighborhoods, where upwardly mobile MA families had gradually moved in and EA families had moved out (transitional); and (3) high income, predominantly EA neighborhoods, where MAs had largely adopted the cultural orientation of the broader society (suburbs).

The SALSA baseline examination was carried out from April 1992 to June 1996 and consisted of a comprehensive home-based assessment, conducted in the participant's home, and a performance-based assessment, conducted at a clinical research center. The study was approved by the Institutional Review Board of the University of Texas Health Science Center at San Antonio, and all subjects gave informed consent.

Measures

Neighborhood—Neighborhoods were classified as described above. The construct of neighborhood captures the context of daily living and quality of life experienced by residents in terms of population density; cultural climate; stressors; sense of belonging and protection; availability of consumer goods, including food, clothing, housing, and medical care; and lifestyle. The continuum from barrio to suburbs represents a gradient of increasing SES and increasing cultural and structural assimilation into the broader society for MAs.¹⁵

Ethnic Group—Ethnic group was classified as MA using a validated, standardized algorithm, which considers parental surnames (maiden name of mother), birthplace of both parents, self-declared ethnic identity, and ethnic background of grand parents.¹⁶

Frailty Characterization—Validated Fried criteria and standardization procedures² were applied to the SALSA sample; standardized SALSA cutpoints have been published previously.³ CHS frailty criteria are the presence of five frailty characteristics: 1) walking speed standardized based on median height and sex, 2) grip strength standardized based on body mass index (BMI) and sex, 3) energy expenditure standardized based on sex, 4) exhaustion based on self-report, and 5) weight loss. Frailty was classified as a dichotomous variable. Individuals with less than 3 frailty characteristics were classified as non-frail, and those with 3 or more characteristics were classified as frail.

Covariates

Chronic Disease—Clinical measures were used to assess diabetes, hypertension, myocardial infarction, chronic obstructive pulmonary disease, proteinuria, and peripheral arterial disease as previously described.¹⁷ Arthritis, cancer (non-skin), and stroke were assessed by self-report of physician-diagnosed disease. Comorbidity was calculated as the number of chronic diseases excluding diabetes, which was considered separately because of prior work demonstrating that it is highly correlated with frailty¹⁸ as well as being a predictor of frailty progression.¹⁹

Cognitive impairment—Cognition was assessed using the Folstein Mini-Mental State Examination (MMSE). A score of less than 24 was considered mild cognitive impairment.²⁰

Depressive Symptoms—Depressive symptoms were assessed using the Geriatric Depression Scale (GDS).²¹ A score of greater than 10 was considered probable depression.

Socioeconomic Status (SES)—Monthly household income and number of years of formal education were assessed by self-report.

Statistical Analysis

Descriptive statistics were used to summarize the data. Differences in participant characteristics by neighborhood were compared using analysis of variance (ANOVA) for continuous variables and the chi-squared statistic for categorical variables. Logistic regression analyses were performed to examine the association of neighborhood type with odds of frailty. Only covariates that significantly varied across the three neighborhood types were included as covariates in the logistic regression analyses. Three sequential models were conducted: Model 1 adjusts for sociodemographic factors (age and sex); Model 2 additionally adjusts for disease factors (diabetes and chronic obstructive pulmonary disease); and Model 3 additionally adjusts for cognitive impairment and depressive symptoms. Analyses were performed using STATA, version 12 (College Station, TX).

RESULTS

Sample Characteristics

Table 1 shows participant characteristics by neighborhood residence. As expected, income and education increased across neighborhood type, from barrio to transitional to suburban. The opposite pattern was observed for diabetes, with prevalence decreasing across neighborhoods from the barrio to the transitional neighborhood to the suburbs, such that diabetes prevalence was almost 2-fold higher in the barrio than in the suburbs (37.9% vs. 19.8%). Frailty prevalence followed a neighborhood pattern similar to that observed for diabetes, with frailty prevalence highest in the barrio (15.6%), intermediate in the transitional neighborhood (9.4%) and lowest in the suburban neighborhood (3.5%) ($p = .01$). Similarly, the prevalence of both depression and cognitive impairment decreased from the barrio to suburbs. Prevalence of cognitive impairment decreased from 49.5% to 23.3% to 4.6% across the three neighborhoods ($p < .001$); while prevalence of probable depression decreased from 32.1% to 21.6% to 8.0% across the three neighborhoods ($p < .001$).

Table 2 shows the logistic regression models for the association between neighborhood residence and frailty. The odds of frailty for barrio vs. suburban residence in Model 1, adjusted for sociodemographic factors, were almost six times higher (OR = 5.72, 95% CI: 1.68–19.45), and neither age nor sex was statistically significant. In Model 2, additionally adjusted for diabetes and chronic obstructive pulmonary disease, the greater odds of frailty in the barrio relative to the suburbs remained statistically significant (OR = 4.15, 95% CI: 1.18–14.60, $p = .026$). Diabetes was associated with over 2.5 greater odds of frailty (OR = 2.74, 95% CI: 1.36–5.51, $p = .006$). In Model 3, after additional adjustment for cognitive

impairment and depressive symptoms, barrio compared to suburban residence was no longer significantly associated with increased odds of frailty (OR = 3.11, 95% CI: 0.83–11.61, $p = 0.836$). Probable depression, but not cognitive impairment, was significantly associated with increased frailty odds (OR = 2.83, 95% CI: 1.33–6.03, $p = .007$).

DISCUSSION

Among older MAs residing in the barrio, transitional, and suburban neighborhoods, the odds of frailty after adjusting for demographic characteristics (age and sex) was over five times greater for barrio vs. suburban residence. This excess odds of frailty was explained largely by neighborhood differences in prevalence of diabetes and depressive symptoms. Cognitive impairment did not have a significant independent effect on frailty prevalence in these analyses.

While initial conceptualizations of frailty excluded individuals with known depression in order to avoid potential confounding with the construct of physical frailty,² a growing body of literature has shown that there is a significant cross-sectional association between depression and frailty.²² And, more recently, Lakey et al. (2013) observed that individuals with anti-depressant use and/or depressive symptoms had greater risk of incident frailty over a 3 year follow-up period compared to those who neither used anti-depressants nor had depressive symptoms.²³ The highest risk was observed for depressed individuals using antidepressants, who had almost 4 times the risk of frailty compared to non-depressed individuals (OR = 3.64, 95% CI: 2.41–5.53). Furthermore, our finding that prevalence of depressive symptoms varies markedly by type of neighborhood is consistent with prior studies showing that adverse neighborhood environment and neighborhood deprivation are associated with depression in older adults.⁸

Only one prior study has examined the effect of neighborhood residence and frailty in MAs. Aranda et al. (2011) studied the effect of neighborhood factors on frailty (using a modification of the Fried criteria)² in a sample of community-dwelling MAs aged 75 years and older in the Hispanic Established Populations for Epidemiologic Studies of the Elderly (H-EPESE) study.¹² In contrast to our findings in SALSA, the H-EPESE found that living in the “barrio,” or a neighborhood with a high proportion of MA residents, may be protective against frailty. More specifically, the study found that older MAs living in a high-density MA neighborhood (60%) were less likely to experience worsening in frailty status over a 2-year follow-up period compared to those living in a low-density MA neighborhood (OR = 0.66, 95% CI: 0.45–0.96).

The difference in findings between the H-EPESE and SALSA with regard to frailty risk associated with “barrio” residence may be explained by differences in the SES of MAs in the two studies. Mean years of formal education in the H-EPESE cohort was approximately 5 years, compared to a mean of 9 years of formal education in the SALSA MA participants. A high proportion of H-EPESE participants (approximately 40%) had an annual income between \$5000 and \$9999,²⁴ while the majority of MA SALSA participants (approximately 55%) had an annual household income of \$15,000 or more. Additionally, while the H-EPESE cohort comprised MAs exclusively, SALSA included both MAs and EAs and

purposely sampled neighborhoods that varied in SES and ethnic composition (or, MA density). The barrio was virtually 100% MA and low-income, the transitional neighborhood was approximately equal in the percent of MAs and EAs (50%) and middle-income, and the suburb neighborhood was about 10% MA and 90% EA and high-income. Taken together, results of the two studies suggest that if SES is similar across neighborhoods of varying MA density, then living in a higher MA density neighborhood may be protective. Conversely, if SES varies across neighborhoods, then living in a low SES, high MA density neighborhood vs. a higher-SES, low MA density neighborhood, may increase risk of frailty. Because the H-EPESE sample was predominantly of lower SES, the Aranda study could not address this issue.

While acknowledging that they were not able to directly examine the association, Aranda et al suggested that higher levels of social cohesion and support may be a potential explanation for their finding of a protective effect of less frailty worsening over time in MAs living in a high density MA neighborhood compared to MAs living in a less dense MA neighborhood. This idea of the protective effect of social support and cohesion is supported by a study by Xue et al. (2007) which showed that older women who left their homes less than four times per week were at 70% increased risk of becoming frail (HR = 1.7, 95% CI: 1.1–2.4), and those who never left their homes were over three times more likely to become frail (HR = 3.2, 95% CI: 1.4–7.5), compared to those who left their homes 4 times per week, demonstrating that higher social engagement was protective against frailty.²⁵ This suggests that the findings of Aranda et al. showing a protective effect of the barrio may be due to increased social engagement of older MAs in their communities. Interestingly, however, Aranda et al. also found that individuals who lived in a high-density MA area were significantly more likely to have private medical insurance than those living in a low-density MA area. This may suggest that there are differences in healthcare access which could partially account for the observed protective effect of the high-density MA neighborhood, although private insurance and financial strain were included in their multivariable models.

Our study has several limitations. First, as with all cross-sectional analyses, no inferences can be made regarding causality. Second, measures of specific neighborhood structural features such as barriers to social and health services, housing, crime, etc., which could be used to measure neighborhood deprivation were not available in SALSA. Third, because this study enrolled older MAs in urban areas of San Antonio, our findings may not be generalizable to rural older adults, to older Hispanics who are not of Mexican descent, or to older MAs living in other geographic areas of the U.S. Fourth, the fact that SALSA baseline data were collected from 1992 to 1996 may raise concern about changes in neighborhood composition, acculturation levels of older MAs, and health indicators that may have occurred over time and the impact of these changes on the current relevance of our findings. The neighborhoods in our study were selected, however, to represent three distinct neighborhood types, varying in levels of socioeconomic status, ethnic composition, and MA's cultural orientation/assimilation to the broader American society. While the composition of the specific census tracts selected to represent these neighborhoods in our study may have changed over the past 20 years, the types of neighborhood represented in this analysis still exist in San Antonio and other areas in Texas and the U.S., and can provide additional insight into neighborhood factors that contribute to differences in frailty

prevalence among MA older adults. A major strength of the SALSA sampling design is its inclusion of older MAs across a broad range of SES and cultural orientation/assimilation to the broader American society.

In summary, we found that residence in the barrio vs. suburban neighborhood was associated with higher odds of frailty prevalence in older MAs; and, that differences in prevalence of diabetes and depressive symptoms largely accounted for the observed neighborhood disparity in frailty prevalence. These findings suggest that, considered together, the ethnic composition and economic environment of the neighborhoods in which older MAs reside are strongly associated with their odds of being frail.

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Table 1

Baseline characteristics by neighborhood in the San Antonio Longitudinal Study of Aging

	Mexican Americans (N = 394)			
	Barrio	Transitional	Suburbs	P-value for neighborhood difference
	N = 218	N = 88	N = 88	
	n (%) or mean(SD) ^a	n (%) or mean(SD) ^a	n (%) or mean(SD) ^a	
Age, years (range: 65–80)	69.2 (3.2)	70.1 (3.2)	68.8 (3.1)	.023
Female (%)	140 (64.2)	47 (53.4)	40 (45.5)	.007
Education, years (range: 0–23)	6.7 (3.8)	9.8 (4.0)	13.4 (3.3)	<.0001
Income, category ^b (range: 1–15)	9.1 (2.7)	10.9 (3.0)	13.3 (2.5)	<.0001
Hypertension	108 (49.5)	48 (54.6)	37 (42.1)	.245
Myocardial Infarction	33 (15.3)	14 (15.9)	8 (9.1)	.314
Angina	22 (10.3)	7 (8.1)	4 (4.6)	.268
Stroke	28 (13.2)	8 (9.1)	6 (6.8)	.231
Arthritis	102 (47.2)	42 (48.3)	29 (33.0)	.052
Cancer (non-skin)	11 (5.1)	10 (11.4)	3 (3.4)	.057
Diabetes	80 (37.9)	23 (28.4)	17 (19.8)	.007
Chronic Obstructive Pulmonary Disease	81 (39.9)	20 (23.3)	19 (22.1)	.002
Proteinuria	30 (16.7)	11 (15.1)	8 (10.7)	.472
Peripheral arterial disease	56 (27.3)	20 (23.0)	15 (17.2)	.177
Chronic conditions, number(range: 0–6)	1.6 (1.4)	1.5 (1.4)	1.2 (1.2)	.152
Cognitive Impairment ^d (%)	105 (49.5)	20 (23.3)	4 (4.6)	<.001
Probable Depression ^e (%)	70 (32.1)	19 (21.6)	7 (8.0)	<.001
Frailty (%)	31 (15.6)	8 (9.4)	3 (3.5)	.010

^a Abbreviations: SD = standard deviation^b Monthly household income categories: 1=\$0–49, 2=\$50–99, 3=\$100–149, 4=\$150–199, 5=\$200–299, 6=\$300–399, 7=\$400–499, 8=\$500–749, 9=\$750–999, 10=\$1,000–1,249, 11=\$1,250–1,499, 12=\$1,500–1,999, 13=\$2,000–2,499, 14=\$2,500–2,999, 15=\$3,000+.^c Chronic conditions was defined as the total number of the following chronic conditions: hypertension, angina, myocardial infarction, peripheral arterial disease, chronic obstructive pulmonary disease, proteinuria, stroke, arthritis, and cancer (non-skin).^d Cognitive impairment was defined as Mini Mental State Examination score of less than 24.^e Probable depression was defined as Geriatric Depression Score of greater than 10.

Table 2
Logistic regression models for the odds of frailty by neighborhood status in Mexican Americans (MAs)

	Model 1		Model 2		Model 3	
	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Transitional vs. suburbs	2.92 (0.74–11.51)	.126	2.60 (0.63–10.64)	.184	1.95 (0.45–8.42)	.371
Barrio vs. suburbs	5.72 (1.68–19.45)	.005	4.15 (1.18–14.60)	.026	3.11 (.83–11.61)	.092
Age (1-year increment)	1.03 (0.93–1.14)	.602	1.02 (0.91–1.14)	.786	0.99 (0.88–1.11)	.833
Sex (male vs. female)	1.67 (0.86–3.24)	.129	1.64 (0.81–3.32)	.167	1.62 (0.79–3.35)	.191
Diabetes (yes vs. no)			2.74 (1.36–5.51)	.005	2.77 (1.34–5.73)	.006
Chronic obstructive pulmonary disease			1.84 (0.90–3.76)	.094		
Cognitive impairment (MMSE < 24 vs. ≥ 24)					1.09 (0.49–2.40)	.836
Probable depression (GDS > 10 vs. ≤ 10)					2.83 (1.33–6.03)	.007