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Lower Frailty Incidence Among Mexican American than Among European American Older Adults: The San Antonio Longitudinal Study of Aging

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Abstract

OBJECTIVES—to directly compare frailty incidence between Mexican American (MA) and European American (EA) older adults.

DESIGN—longitudinal, observational cohort study.

SETTING—socioeconomically diverse neighborhoods in San Antonio, TX.

PARTICIPANTS—301 MAs and 305 EAs in the San Antonio Longitudinal Study of Aging (SALSA) who were non-frail at baseline.

MEASUREMENTS—Frailty was assessed at baseline and three follow-ups conducted over an average of 9.9 years using well-established criteria from the Cardiovascular Health Study. Covariates included baseline age, sex, socioeconomic status (SES), pre-frailty status, diabetes, and comorbidity. The adjusted ethnic odds (MA vs. EA) of incident frailty were estimated using generalized estimating equations.

RESULTS—There was no ethnic difference in the unadjusted incidence of frailty over the three follow-up examinations (OR=0.97, 95%CI: 0.62–1.52), even though baseline SES was significantly lower among MAs than among EAs. After covariate adjustment, the odds of incident frailty were significantly lower in MAs compared to EAs (OR=0.40, 95%CI: 0.23–0.72). Other significant predictors of frailty in the adjusted model were pre-frailty (ORpresent vs. absent =

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Author Contributions: Sara Espinoza: study concept and design, statistical analysis and interpretation of data, and manuscript preparation. Inkyung Jung: study design, statistical analysis and interpretation of data, and manuscript preparation. Helen Hazuda: study concept and design, study concept and design for cohort, interpretation of data, and manuscript preparation.

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3.19, 95%CI: 1.86–5.47), education (OR1-year increment = 0.89, 95%CI: 0.83–0.96), and income (OR1-year increment = 0.88, 95%CI: 0.79–2.04).

CONCLUSION—These findings lend support to the Hispanic Paradox and suggest that MAs who live to older ages compared with similarly aged EAs are less likely to become frail. Further research is needed to identify the underlying biological and social mechanisms which explain this finding in order to enhance the development of interventions for the prevention and treatment of this clinical geriatric syndrome.

Keywords

frailty; ethnic differences; older adults

INTRODUCTION

Frailty has been described as a syndrome of lack of resilience with age.[1, 2] Frail individuals are thought to exhibit certain defining characteristics, such as weakness, slowness, wasting, low physical activity, and exhaustion.[3] Standardized screening criteria for frailty derived from Cardiovascular Health Study (CHS) data have been shown to predict important adverse health outcomes with age, including falls, disability, institutionalization, and death.[3–5] While the bulk of this research involves studies of longitudinal cohorts comprised predominantly of Caucasians, some studies have examined frailty in ethnic minorities. The latter generally show that frailty prevalence is higher in ethnic minorities than in European Americans, or non-Hispanic whites, but that frailty incidence is similar.[6–8] Studies that included Hispanics, however, were conducted in cohorts comprised exclusively of a single Hispanic subgroup (i.e., Mexican Americans)[8] or cohorts that included a small proportion of Hispanics from heterogeneous subgroups (i.e., Mexican American, Cuban, Puerto Rican, and Central and South American).[4] Our previous study of frailty prevalence in the San Antonio Longitudinal Study of Aging (SALSA), a unique bi-ethnic cohort comprised of nearly equal proportions of Mexican American (MAs) and European American (EAs) older adults, was the first to directly compare frailty prevalence between these two ethnic groups, and found a higher prevalence of frailty among MAs compared with EAs based on the CHS screening criteria.[7] The purpose of the current study was to determine whether incident frailty over an average follow-up period of 9.9 years (range: 7.4–12.5) was also greater or no different in MAs compared with EAs when these two ethnic groups were directly compared within the same cohort.

METHODS

Sample

Subjects were individuals who participated in the baseline and at least one of three follow-up examinations of SALSA. SALSA participants were the oldest members, aged 65 and older, of the San Antonio Heart Study (SAHS) cohort[9] who were recruited for the SALSA baseline examination conducted from 1992 to 1996. In SAHS, subjects were randomly sampled from low-, middle-, and high-income neighborhoods in order to provide a cohort with comparable numbers of MAs and EAs and to maximize sociocultural variation among MAs in the study. Ethnic group was classified as MA or EA using a standardized, validated algorithm.[10] Of 1,247 eligible SAHS subjects, 166 had died prior to the start of SALSA and an additional 19 died prior to completion of the baseline exam. Of the remaining 1,062 individuals, 749 completed the baseline examination for a response rate of 70.5%. Three follow-up exams were conducted between 2000 and 2005, 18 months apart. Four-hundred seventy-four of 600 survivors (79.0%) participated in follow-up 1, 413 of 563 survivors (73.4%) in follow-up 2, and 375 of 528 survivors (71.0%) in follow-up 3. Between baseline

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and follow-up 3, 221 of 749 (29.5%) baseline participants died. There was no evidence of differential response bias between MAs and EAs over the 9.9 year follow-up interval from baseline to the third follow-up.

The SALSA baseline and follow-up examinations consisted of a comprehensive home-based assessment, conducted in the participant's home, and a performance-based assessment, conducted at a clinical research center. Trained, bilingual staff administered assessments in English or Spanish, according to the participant's preference. 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.

Frailty Characterization

The validated CHS screening criteria were used to characterize frailty as the presence of three or more of five characteristics: slow walking speed, weak grip strength, low energy expenditure, self-reported exhaustion, and weight loss.[3] These criteria were standardized to the pooled sample of MAs and EAs using the procedures developed in the CHS.

Walking Speed—Subjects were timed in seconds as they walked 10 feet, at their usual pace, starting from a standing position. Walking speed was standardized based on median height and sex. Participants in the slowest quintile for each sex group were considered slow.

Grip Strength: Grip strength was measured in kilograms using a handheld dynamometer in the dominant hand, and was standardized based on body mass index (BMI) quartiles and sex. Participants in the lowest quintile for each sex group were considered weak.

Energy Expenditure—Self-reported physical activity over the previous year was assessed using the Minnesota Leisure Time Physical Activity Questionnaire, which yields average energy expenditure in kilocalories per week,[11] and was standardized based on sex. Participants in the lowest quintile for each sex group were considered to have low energy expenditure.

Exhaustion—Exhaustion was measured by the Geriatric Depression Scale[12] question, "Do you feel full of energy?" Subjects who responded "no" to this question were considered exhausted.

Weight Loss—Weight loss was assessed by response to the question, "In the last year have you gained or lost more than 10 pounds?" Response choices were: gained only, lost only, both gained and lost, or neither. Intentionality was not assessed. Only those participants who reported that they had lost but not gained weight were considered as having weight loss.

Based on presence of these five characteristics, frailty can be classified as a dichotomous variable (≥ 3 characteristics = frail, < 3 characteristics = non-frail) or as a trichotomous variable (≥ 3 characteristics = frail, 1–2 characteristics = pre-frail, 0 characteristics = non-frail). The proportion of individuals whose frailty status cannot be classified due to missing data is greater when the trichotomous variable is used. Thus, frailty incidence was estimated based on the dichotomous variable; however, in order to examine the association of pre-frailty with subsequent frailty incidence, baseline frailty was classified using the trichotomous variable.

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Covariates

Chronic Disease—Clinical measures were used to assess diabetes (American Diabetes Association criteria),13 hypertension (Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure 6 guidelines),14 and myocardial infarction (12-lead ECG). Angina pectoris was assessed using the Rose questionnaire.15 Arthritis, cancer (non-skin), congestive heart failure, osteoporosis and stroke were assessed by self-report of physician-diagnosed disease. Comorbidity (presence of multiple chronic diseases) was calculated both as a dichotomous variable (presence of at least two diseases versus none or one) and a continuous variable (number of diseases present). When comorbidity was included in multivariable models with diabetes as a separate covariate, comorbidity was calculated as the presence of at least two diseases exclusive of diabetes.

Incontinence—Bladder and bowel incontinence were assessed by self-report measures, as previously described.[16]

Impairment—Cognitive impairment was assessed using the Folstein Mini-Mental State Examination.[17] Those with a score of less than 24 were classified as mildly cognitively impaired. Near and far vision impairment was assessed using methods developed in the Established Populations for the Epidemiologic Study of the Elderly (EPESE).[18] Near vision was assessed by self-reported ability to read ordinary newsprint, and far vision by self-reported ability to recognize a friend across the street. Hearing impairment was determined using an audioscope and classified as present or absent. Depressive symptoms were measured using the Geriatric Depression Scale;12 those with scores ≥11 were classified as having depressive symptoms.

Socioedemographic characteristics

Monthly household income, number of years of formal education, living alone or with others, marital status, frequency of social contacts, and the number of intimate confidants were assessed by self-report.

Physical function and dependence—Physical function was assessed using the Short Physical Performance Battery (SPPB), a lower extremity physical performance battery constructed from 10-foot walking times, repeated chair stands, and balance scores.19 Scores for the three measures were summed to create a total score, ranging from 0 to 12. Higher scores indicate better performance, i.e. less functional limitation. Dependence, i.e., needing help from others, in activities of daily living (ADL) was measured with the modified Katz scale for use in the general population,20–22 and assessed difficulty in seven self-care activities: bathing, personal grooming, dressing, eating, using the toilet, getting from a bed to a chair, and walking across a small room. Dependence in instrumental activities of daily living (IADL) was measured using the OARS instrument as modified for the EPESE studies, 23 and assessed difficulty in seven activities related to household management and integration with the community: using the telephone, driving own car or traveling alone, going shopping for groceries or clothes, preparing own meals, doing housework, taking medications, and handling money. For both ADL and IADL dependence, scores are the sum of activities in which the subject is dependent.

Statistical Analysis

Descriptive statistics were used to summarize the data. Ethnic differences in presence and classification of frailty, completion rates, and mortality were compared using the chi-squared statistic. Ethnic differences in demographic, SES, and comorbid diseases were compared using the chi-squared statistic for categorical variables and two sample *t*-tests for

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continuous variables. The ethnic odds ratio at baseline was estimated using a logistic regression model. A generalized estimating equations (GEE) approach for longitudinal logistic regression was used to estimate the ethnic odds ratio (OR) for incident frailty over the three SALSA follow-up periods. The GEE method accounts for correlations among repeated measurements of frailty status over time within an individual and uses all available data points. These analyses were adjusted for pertinent covariates (baseline pre-frailty status, age, sex, diabetes, comorbidity, and SES). Statistical analysis was performed using SAS, version 9.1.

RESULTS

At the SALSA baseline exam, complete information was available to classify presence or absence of frailty using the trichotomous frailty variable in 672 of 749 individuals. Individuals who were classified as frail at baseline (n=66: 42 MAs and 24 EAs) were excluded from the analysis of frailty incidence, leaving 606 individuals available for this study.

Baseline characteristics of the participants are presented in Table 1. At baseline, MAs, compared to EAs, were slightly younger, had fewer years of education, and lower household income. There was no significant ethnic difference in marital status, although more EAs than MAs reported living alone. MAs were more likely than EAs to have diabetes, while EAs were more likely than MAs to have cancer. However, there was no significant ethnic difference in the number of chronic diseases or the presence of comorbidity (calculated with or without the inclusion of diabetes). More MAs reported depressive symptoms and met criteria for mild cognitive impairment, while more EAs reported urinary incontinence. MAs had lower levels of physical function and reported higher dependence in IADLs, but there was no significant ethnic difference in ADL dependence. Using the dichotomous classification, frailty prevalence was significantly higher in MAs (12.2%) compared to EAs (7.3%). Using the trichotomous classification, there was no significant ethnic difference in frailty categories, although a higher proportion of MAs compared with EAs were classified as frail and a higher proportion of EAs compared with MAs were classified as pre-frail.

The ethnic odds ratios of frailty using the dichotomous variable at the baseline exam are shown in Table 2, both unadjusted and in a model adjusted for age, gender, education, income, diabetes, comorbidity, and pre-frailty status. Prior to covariate adjustment, MAs were significantly more likely than EAs to be frail at baseline (OR = 1.77, 95% CI: 1.05–3.0). In the adjusted model, however, the odds of being frail at baseline did not differ between the ethnic groups. Covariates significantly associated with baseline frailty were diabetes and household income. Those with diabetes were more likely to be frail (OR = 2.74, 95% CI: 1.51–5.0), while those with higher incomes were less likely to be frail (OR = 0.83, 95% CI: 0.76–0.93).

Table 3 shows frailty status, completion status, and survival over the three follow-up exams. Average length of follow-up was 9.9 years (range: 7.4 – 12.5 years). Incident frailty in the total cohort was highest at follow-up 1 (9.1%) and similar at follow-ups 2 and 3 (6.8% and 7.8%, respectively). Deaths increased monotonically over the follow-ups in the total cohort and within ethnic groups. There were no significant ethnic differences in the distribution of frailty, vital status, or completer status at any follow-up. Mortality was higher in MAs compared with EAs at all follow-ups; however, this ethnic difference did not reach statistical significance.

Table 4 shows the ethnic odds ratios of incident frailty over the three follow-ups in both an unadjusted model and a model adjusted for baseline age, sex, SES, diabetes, comorbidity,

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and pre-frailty status. In the unadjusted model, MAs and EAs were equally likely to become frail (OR = 0.97, 95%CI: 0.62–1.52). After covariate adjustment, however, MAs were 60% less likely than EAs to develop incident frailty (OR = 0.40, 95%CI: 0.23–0.72). Participants who were pre-frail at baseline were over three times more likely to develop incident frailty over the follow-up period compared to those who were non-frail (OR = 3.19, 95% CI: 1.86–5.47). Neither diabetes nor comorbidity was a significant predictor of incident frailty, although diabetes was strongly associated with presence of frailty at baseline. Both education and income were significantly associated with lower incident frailty. Males were more likely than females to become frail, but this association was only marginally statistically significant.

DISCUSSION

This study examined the ethnic difference in frailty incidence in a community-based sample of MAs and EAs over an average follow-up period of 9.9 years. In spite of higher frailty prevalence and lower SES at baseline, there was no ethnic difference in frailty incidence in an unadjusted model; and, after covariate adjustment, the odds of incident frailty in MAs compared with EAs were actually 60% lower.

To date, only a small number of studies have examined ethnic differences in both frailty prevalence and incidence. In the CHS, in which African Americans comprised 13.2% of the cohort (n=5317), both frailty prevalence and 4-year incidence were higher in African Americans than in EAs (prevalence: 12% vs. 6%, incidence: 11% vs. 7%).[3] The Women's Health Initiative (WHI) cohort (*n*=40,657), which included relatively higher proportions of African American women as well as Hispanic women,[4] found that baseline frailty prevalence was higher in both African American (28.4%) and Hispanic women (19.6%) compared to that in EAs (15.3%). However, in a multivariable model adjusted for multiple factors, including age, SES, comorbidity, BMI, tobacco and alcohol use, and self-reported health, the investigators found that African American women were less likely than EA women to become frail at three years of follow-up, and found no difference in frailty incidence between Hispanics and EAs. Because participants in the WHI were recruited from 40 clinical centers across the U.S., however, it is likely that Hispanics in the sample were from heterogeneous subgroups (i.e., Mexican Americans, Cuban Americans, Puerto Ricans, and Central and South Americans), limiting generalizability to any specific subgroup. In contrast, the Hispanic Established Populations for Epidemiologic Study of the Elderly (H-EPESE) cohort is comprised exclusively of MAs and found frailty prevalence at baseline to be 20% (*n* = 721), comparable to that reported for Hispanic women in the WHI and at least two times higher than prevalence rates reported for EAs in the CHS.4, 8 A subsequent analysis of 7-year frailty incidence in the H-EPESE showed a rate of 7.9%,[24] comparable to that reported in the predominantly EA CHS cohort (7.0%), leading the investigators to conclude that there may be no ethnic difference in frailty incidence between MAs and EAs.

Most studies established prior to development of the CHS (including ours) have used modified versions of the CHS criteria because data required to address all of the criteria using measures identical to those in the CHS were not included in these studies. In the WHI cohort, for example, because physical performance measures (i.e., timed walk and grip strength) were not available, data for speed and strength were obtained from the Medical Outcomes Study Short Form-36 (MOS SF-36) Physical Function Scale, which measures self-reported limitations in physical function.[25] In the H-EPESE, data on physical activity was not available; therefore, frailty classification was based on only four of the CHS criteria (weight loss, exhaustion, walking speed, and grip strength). In spite of these variations in application of the CHS criteria, both the WHI and the H-EPESE found either similar or lower incidence of frailty in the ethnic groups studied, even though baseline prevalence in

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the ethnic minority groups exceeded that in EAs. In the present study, which also used previously described modified criteria to directly compare frailty incidence between MAs and EAs within the same cohort, we not only found no ethnic difference in the unadjusted incidence of frailty over an average of 9.9 years of follow-up, but found that frailty incidence was actually 60% lower in MAs compared to similarly aged EAs following covariate adjustment.

Frailty is a strong predictor of subsequent mortality.[3] Thus, our finding of similar frailty incidence in MAs compared with EAs in the presence of lower SES in MAs, a known risk factor for frailty,[4] is consistent with the Hispanic paradox, an epidemiologic phenomenon of relatively lower or similar mortality in Hispanic Americans in spite of higher disease burden, risk factors, and suboptimal SES compared to EAs.[26, 27] While the Hispanic paradox has been controversial, a comprehensive review of 20 years of data shows a consistent mortality advantage in Hispanic Americans, particularly MAs, compared with EAs. Further, while that advantage is present in all age groups, it is particularly apparent in older adults.[28] In keeping with the Hispanic paradox, our findings may suggest that older MAs have greater resiliency as they age compared to similarly aged EAs.

Nonetheless, it is important to consider alternative explanations for our finding of an apparent MA advantage against frailty. One possible explanation is that a survivorship bias was present at SALSA baseline because less fit MAs were more likely than EAs to have died prior to the study's inception, thereby leaving a relatively robust group of MAs to participate in the study. To investigate this possibility, we used data from the San Antonio Heart Study parent study and examined ethnicity and survival status at SALSA baseline among the 1247 SALSA eligibles to determine whether there was an ethnic*survival interaction effect on a variety of available health-related variables: age, sex, education, diabetes, cardiovascular disease arthritis, perceived health, disability days and any hospitalization in previous year, and smoking status (analyses not shown). After Bonferroni adjustment for multiple tests, the only statistically significant ethnic*survival interaction effect observed was for diabetes, and the interaction effect provided little evidence of a substantial survivor bias among MAs relative to EAs. More specifically, prevalence of diabetes was greater among decedents than among survivors in both ethnic groups (MAs: 51.4% vs. 23.1% in decedents and survivors, respectively; EAs: 18.5% vs. 11.1% in decedents and survivors, respectively. Thus, while the difference in diabetes prevalence between decedents and survivors was greater in MAs than in EAs (hence, the significant ethnic*survivor interaction effect), the prevalence of diabetes among MA survivors was twice as high as that among EA survivors. Thus, it is difficult to conclude that the MA survivors represented a relatively robust group relative to the EA survivors. Further, the overall baseline characteristics (Table 1) of the SALSA sample do not support the premise of a survivorship bias among the MAs. In fact, MAs were significantly more likely than EAs to have diabetes, stroke (marginally significant), depressive symptoms, visual impairment, and cognitive impairment. They also had lower household income, education, physical function, and greater dependence in IADLs compared to EAs. Given that the MAs in this study were at medical, physical, and socioeconomic disadvantages, we might have expected that without adjustment, MAs would experience greater frailty incidence compared to EAs. However, in keeping with the Hispanic paradox, we found that prior to covariate adjustment there was in fact no ethnic difference in the unadjusted incidence of frailty; and, after covariate adjustment, MAs experienced lower frailty incidence than did EAs.

Another potential alternate explanation for our findings is that there was an unobserved ethnic difference in access to preventive and rehabilitation services and/or comprehensive geriatric assessments and treatment that may have delayed the onset of frailty among MAs relative to EAs. We did not monitor the use of such services over the course of the follow-

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ups and, therefore, have not direct data to address this possibility. However, given the lower education and income of MAs in the sample relative to EAs, it seems likely that any ethnic difference in the use of such services would favor EAs rather than MAs.

Weaknesses of the present study that should be noted include minor modifications of the CHS criteria, the relatively small sample size, and the potential that results obtained for MAs living in a single major urban area in south Texas may not be generalizable to MAs living in other urban areas in the U.S. or those living in rural areas. Counterbalancing these weaknesses are several important strengths, including direct comparisons of frailty incidence within a bi-ethnic cohort of MAs and EAs, and an average follow-up period of 9.9 years, seven years longer than that in the WHI study and three years longer than that in the H-EPESE study.

In summary, the findings of this SALSA study suggest that MAs may retain more resiliency as they age compared to similarly aged EAs. Putting these findings into clinical perspective, it is likely that frailty onset occurs with equal frequency in comparably aged older MAs and EAs, in spite of the relatively lower socioeconomic background of many MAs. At any given time, clinicians can expect frailty prevalence among their older patients to be higher in MAs than in EAs; however, the risk of developing new frailty over the next 10 years is equally likely in their older MA and EA patients (approximately 8–10%). Therefore, clinicians should exercise similar diligence with patients from both ethnic groups in assessing and intervening on risk factors for frailty as well as considering the social and economic situations of their patients and how those may affect future clinical outcomes.

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Table 1

Baseline Characteristics of Participants Who Were Non-Frail or Pre-Frail at Baseline

	Mexican Americans n=301	European Americans n=305	Total n=606	P-value for Ethnic Difference
	n(%) or mean(SD)*	n(%) or mean(SD)*	n(%) or mean(SD)*	
Age, years (range: 65–78)	69.1 (3.2)	70.1 (3.5)	69.6 (3.4)	<0.001
Female	170 (56.5)	181 (59.3)	351 (57.9)	0.47
Education, years (range: 0–23)	9.4 (4.6)	13.4 (2.6)	11.4 (4.2)	<0.001
Income, category† (range: 1–15)	10.8 (3.3)	12.9 (2.3)	11.8 (3)	<0.001
Hypertension	142 (47.2)	155 (50.8)	297 (49)	0.37
Myocardial Infarction	33 (11.0)	32 (10.5)	65 (10.7)	0.85
Angina	21 (7.0)	20 (6.6)	41 (6.8)	0.83
Stroke	26 (8.6)	15 (4.9)	41 (6.8)	0.07
Diabetes	82 (28.9)	24 (9.2)	106 (19.4)	<0.001
Arthritis	133 (44.2)	147 (48.2)	280 (46.2)	0.32
Cancer (non-skin)	16 (5.3)	38 (12.5)	54 (8.9)	0.002
Congestive heart failure	0 (0.0)	0 (0.0)	0 (0.0)	N/A
Osteoporosis	0 (0.0)	0 (0.0)	0 (0.0)	N/A
Chronic diseases‡ number (range: 0–6)	1.5 (1.1)	1.4 (1.0)	1.5 (1.1)	0.43
Comorbidity§	137 (46.8)	123 (42.9)	260 (44.8)	0.34
Comorbidity, excluding diabetes	109 (37.2)	116 (40.4)	225 (38.8)	0.43
Depressive symptoms	53 (17.6)	24 (7.9)	77 (12.7)	<0.001
Urinary incontinence	69 (23.0)	105 (34.9)	174 (29.0)	0.001
Cognitive impairment	81 (26.9)	16 (5.2)	97 (16.0)	<0.001
Hearing impairment	100 (33.2)	95 (31.4)	195 (32.3)	0.62
Far-vision impairment	22 (7.3)	9 (3.0)	31 (5.1)	0.01
Near-vision impairment	10 (3.3)	6 (2.0)	16 (2.6)	0.3
Married	210 (70.2)	211 (69.2)	421 (69.7)	0.78
Living alone	45 (15.1)	77 (25.2)	122 (20.2)	0.002
Social contacts, mean (range: 0–18)	9.2 (3.7)	9.7 (3.4)	9.5 (3.6)	0.06
Intimate confidants, number (range: 0–5)	1.9 (1.5)	1.8 (1.3)	1.8 (1.4)	0.28
Physical function (range: 0–12)	10 (2.1)	10.4 (1.7)	10.2 (1.9)	0.01
ADL Dependence, (range: 0–5)	0.1 (0.5)	0.1 (0.4)	0.1 (0.4)	0.15
IADL Dependence, (range: 0–7)	0.3 (0.9)	0.1 (0.3)	0.2 (0.7)	<0.001
Frailty status, dichotomous				
Non-frail or Pre-frail	301 (87.8)	305 (92.7)	606 (90.2)	0.03
Frail	42 (12.2)	24 (7.3)	66 (9.8)	
Frailty status, trichotomous				

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	Mexican Americans n=301	European Americans n=305	Total n=606	P-value for Ethnic Difference
	n(%) or mean(SD)*	n(%) or mean(SD)*	n(%) or mean(SD)*	
Non-frail	124 (36.2)	125 (38.0)	249 (37.1)	NS
Pre-frail	177 (51.6)	180 (54.7)	357 (53.1)	
Frail	42 (12.2)	24 (7.3)	66 (9.8)	

*Abbreviations: SD = standard deviation, ADL = activities of daily living, IADL = instrumental activities of daily living, range = observed range in sample.

†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=$1000–1249, 11=$1250–1499, 12=$1500–1999, 13=$2000–2499, 14=$2500–2999, 15=$3000+. Dollar equivalents of annual household incomes are: 10=$13,500, 11=$16,500, 12=$21,000, 13=$27,000.

‡Chronic diseases included seven chronic conditions: diabetes, angina, hypertension, myocardial infarction, stroke, arthritis, and cancer (non-skin).

§Comorbidity defined as presence of two or more of the seven chronic conditions, listed above.

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Table 2

Odds of Frailty (Dichotomous) at the Baseline Examination of the San Antonio Longitudinal Study of Aging.

Unadjusted Model	**OR* (95% CI)**	**P-value**
Ethnicity (MAs vs. EAs)	1.77 (1.05–3)	0.03
Multivariate Model		
Ethnicity (MAs vs. EAs)	0.76 (0.37–1.58)	0.47
Age (1-year increment)	1.00 (0.92–1.09)	0.96
Gender (male vs. female)	1.66 (0.90–3.06)	0.10
Education (1-year increment)	0.99 (0.91–1.07)	0.76
Income† (1-category increment)	0.83 (0.74–0.92)	<0.001
Diabetes	2.74 (1.51–5.00)	<0.001
Comorbidity,‡ excluding diabetes	1.53 (0.87–2.70)	0.14

*Abbreviations: OR = odds ratio, CI = confidence interval, MA = Mexican American, EA = European American

†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=$1000–1249, 11=$1250–1499, 12=$1500–1999, 13=$2000–2499, 14=$2500–2999, 15=$3000+.

‡Comorbidity is defined as the presence of two or more of six chronic diseases: angina, hypertension, myocardial infarction, stroke, arthritis, and cancer (non-skin). The reference category is the presence of one or none of these chronic diseases. Diabetes is not included as this is considered as a separate covariate.

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Table 3

Status of Participants in Incidence Sample* at Each Follow-up (F/U)

	Total n=606	Mexican Americans n=301	European Americans n=305	P-value for Ethnic Difference
	n (%)	n (%)	n (%)	
Frailty status at F/U 1				
Non-frail	337 (55.6)	160 (53.2)	177 (58)	0.43
Frail	55 (9.1)	30 (10.0)	25 (8.2)	
Cannot Classify Frailty Status	18 (3.0)	12 (4.0)	6 (2.0)	
Non-completer	100 (16.5)	48 (15.9)	52 (17.0)	
Deceased	96 (15.8)	51 (16.9)	45 (14.8)	
Frailty status at F/U 2				
Non-frail	309 (51)	146 (48.5)	163 (53.4)	0.19
Frail	41 (6.8)	17 (5.6)	24 (7.9)	
Cannot Classify Frailty Status	5 (0.8)	4 (1.3)	1 (0.3)	
Non-completer	122 (20.1)	61 (20.3)	61 (20.0)	
Deceased	129 (21.3)	73 (24.3)	56 (18.4)	
Frailty status at F/U 3				
Non-frail	273 (45)	131 (43.5)	142 (46.6)	0.38
Frail	47 (7.8)	20 (6.6)	27 (8.9)	
Cannot Classify Frailty Status	5 (0.8)	4 (1.3)	1 (0.3)	
Non-completer	129 (21.3)	64 (21.3)	65 (21.3)	
Deceased	152 (25.1)	82 (27.2)	70 (23.0)	

* Incidence sample excludes participants who were classified as frail at baseline (n=66). Non-completers are individuals known to be alive who did not complete the examination.

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Table 4

Odds Ratio of Frailty over Three Follow-Up Periods for Those Who Were Not Classified as Frail at Baseline

Unadjusted Model	**OR* (95% CI)**	**P-value**
Ethnicity (MAs vs. EAs)	0.97 (0.63–1.52)	0.91
Multivariate Model		
Ethnicity (MAs vs. EAs)	0.40 (0.23–0.72)	0.002
Pre-Frailty (present vs. absent)	3.19 (1.86–5.47)	<0.001
Age (1-year increment)	1.08 (1.00–1.16)	0.08
Gender (male vs. female)	1.67 (0.97–2.89)	0.06
Education (1-year increment)	0.89 (0.83–0.96)	0.002
Income (1-category increment)†	0.88 (0.79–2.04)	0.02
Diabetes	1.70 (0.89–3.25)	0.11
Comorbidity,‡ excluding diabetes	1.21 (0.71–2.04)	0.48

*Abbreviations: OR = odds ratio, CI = confidence interval, MA = Mexican American, EA = European American.

†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=$1000–1249, 11=$1250–1499, 12=$1500–1999, 13=$2000–2499, 14=$2500–2999, 15=$3000+.

‡Comorbidity is defined as the presence of two or more of six chronic diseases: angina, hypertension, myocardial infarction, stroke, arthritis, and cancer (non-skin). The reference category is the presence of one or none of these chronic diseases. Diabetes is not included as this is considered as a separate covariate.