JOURNAL OF WOMEN'S HEALTH
Volume 18, Number 10, 2009

DOI: 10.1089/jwh.2008.1083

Original Article

Sex Differences in Mortality among Older Frail Mexican Americans

Ivonne-Marie Berges, Ph.D.,[1,2] James E. Graham, Ph.D., D.C.,[1] Glenn V. Ostir, Ph.D.,[1,2,3] Kyriakos S. Markides, Ph.D.,[2,4] and Kenneth J. Ottenbacher, Ph.D., O.T.R.[1,2]

Abstract

Objective: To examine the association between frailty and 10-year mortality among older men and women of Mexican American origin.
Methods: Data were collected from 1995–1996 through 2004–2005 among community-dwelling Mexican Americans aged ≥65 years as part of the Hispanic Established Population for the Epidemiologic Study of the Elderly (HEPESE). A standardized frailty measure based on weight loss, exhaustion, grip strength, walking speed, and physical activity was computed. Data were collected on sociodemographics and health characteristics, comorbidities, and performance-based functional measure.
Results: The sample was 59% female, and mean baseline age was 74.5 years of (SD 6.06) at baseline. Hazard ratios (HR) indicated an increased mortality risk in frail men (HR = 3.04, 95% CI 2.16-4.28) compared with frail women (HR = 1.92, 95% CI 1.39-2.65).
Conclusions: Frailty is an independent predictor of mortality among older men and women of Mexican American origin. This association was found to be stronger among men after adjusting for age, marital status, education, body mass index (BMI), health behaviors, and medical conditions.

Introduction

Frailty has been recognized as a clinical condition associated with institutionalization,[1] disability, morbidity, and mortality in the older adult.[2–5] Although the concept still lacks a consensus definition, frailty has commonly been characterized as an aggregate of physiological markers, such as increased vulnerability to stressors, weight loss, and impaired endurance, strength, and balance.[1,6,7]

Research on frailty in older Hispanics is scarce despite accumulated evidence of differences in disease prevalence and health trajectories among racial and ethnic populations.[8,9] For instance, Hispanic older adults have a higher incidence of diabetes mellitus and obesity and have more limited access to healthcare services than do non-Hispanic whites.[9] These factors combined could potentially impact the outcome of frailty in this minority population.

Studies examining differences in frailty and mortality among older men and women have mostly focused on non-Hispanic black and non-Hispanic white populations.[1,6,7,10–12] These studies show a higher mortality rate among frail women compared with frail men independent of disability and chronic disease. To our knowledge, no study has examined sex differences in the association between frailty and mortality in an older Hispanic population.

The purpose of the study was to examine the association between frailty, as defined by Fried et al.,[6] and 10-year mortality in a well-defined sample of community-dwelling older men and women of Mexican American origin. Based on previous investigations in non-Hispanic white older adults,[11] we hypothesized that the association between frailty and mortality would differ between sexes and that frail women would have an increased mortality risk compared with their male counterparts.

Materials and Methods

Sources of data

The Hispanic Established Population for the Epidemiologic Study of the Elderly (HEPESE) is an ongoing longitudinal study of 3050 noninstitutionalized Mexican Americans aged ≥65 years at baseline (1993–1994) from five Southwestern

[1]Division of Rehabilitation Sciences, [2]Sealy Center on Aging, [3]Department of Internal Medicine, Division of Geriatrics, and [4]Department of Preventive Medicine and Community Health, University of Texas Medical Branch, Galveston, Texas.

states: Texas, California, Colorado, New Mexico, and Arizona. The HEPESE data comprise subjects representative of approximately 500,000 older Mexican Americans over these five states. The baseline sample was selected using an area probability sample design involving a list of counties in the Southwestern states that contained approximately 90% of Mexican Americans residing in these states. At each wave (approximately 2–3-year intervals), data were collected via in-home interviews by raters who received training in assessments of physical functioning, gait, and functional daily living skills. The interviews were conducted in Spanish or English by trained personnel according to the respondent's choice.

Components of the frailty measure were incorporated at the second wave of data collection (1995–1996). The current dataset contains the 10-year period from wave 2 (1995–1996) through wave 5 (2004–2005) of the HEPESE. Individuals with proxy interviews were excluded from the sample because of the physical nature of some components of the frailty measure. In-person interviews at wave 2 were conducted with 2438 of the original subjects. Of those, 272 proxy interviews were excluded, 57 subjects were lost to follow-up (i.e., wave 2 was their last interview), and 113 had missing data on more than two of the five frailty items, resulting in a final sample of 1996 subjects.

Measures

Mortality. Reported deaths over the 10-year study were assessed at each follow-up by reports of family members and verified through the National Death Index (NDI).

Frailty. Frailty was assessed in accordance with criteria developed by Fried et al.,[6] with the exception of the measure of physical activity. The original frailty measure[6] used the short version of the Minnesota Leisure Time Activity questionnaire; we used the Physical Activity Scale for the Elderly (PASE).[13] The five-item frailty scale includes weight loss, exhaustion, walking speed, grip strength, and physical activity. Subjects who had an unintentional weight loss of >10 lbs since the last interview were categorized as positive for the weight loss criterion (score = 1). Exhaustion was assessed using two items from the Center for Epidemiologic Studies–Depression (CES-D) scale: I felt that everything I did was an effort, and I could not get going. The items asked: How often in the last week did you feel this way? 0 = rarely or none of the time (<1 day); 1 = some or a little of the time (1–2 days); 2 = a moderate amount of the time (3–4 days); 3 = most of the time (5–7 days). Subjects answering 2 or 3 to either of these two items were categorized as positive for the exhaustion criterion (score = 1). Walking speed was recorded over a 16-foot timed walk. Subjects unable to complete the walk or who scored in the lowest 20% based on gender and height were categorized as positive (score = 1). Grip strength was assessed by different criteria for men and women using a hand-held dynamometer (Jaymar Dynamometer model 5030J1, J.A. Preston Corpo, Jackson, MI).Those unable to perform the test or those who scored in the lowest 20% adjusted for body mass index (BMI) and stratified by gender were categorized as positive for the weakness criterion (score = 1). Physical activity was assessed by the PASE.[13] Subjects who scored in the lowest 20% of the PASE, adjusted for gender, were categorized as positive for the low physical activity criterion (score = 1). The total frailty scored ranged from 0 to 5. Subjects scoring 0 were categorized as not frail; subjects scoring 1 or 2 were categorized as prefrail; and those scoring 3–5 were categorized as frail.

Covariates. Covariates were selected according to their potential association with frailty. They included sociodemographic factors: age (continuous), gender, BMI (continuous), education (0–5, 6–11, or 12+ years), and marital status (not married = 0, married = 1). Medical conditions were based on self-reported diagnosis (no = 0, yes = 1). For example, individuals were asked: Has a doctor told you that you had a heart attack, stroke, hypertension, cancer, hip fracture, or diabetes. History of smoking was assessed with the question: Do you smoke cigarettes now? (no = 0, yes = 1).

Statistical analysis

We examined the data using descriptive and univariate statistics for continuous variables and contingency tables (chi-square) for categorical variables among those who survived vs. those who died. First, we assessed the interaction between sex differences and mortality risk in unadjusted and adjusted models and obtained significant results. Drawing on these results, we proceeded to stratify our multivariate analysis by men and women. Separate Cox proportional hazard models were computed to estimate the frailty-related hazard ratios (HR) for mortality over the 10-year study period for men and women using the three-level frailty categorization (nonfrail, prefrail, and frail) and controlling for demographics (age, marital status, and education) and health characteristics (BMI and history of smoking, heart attack, stroke, hypertension, cancer, hip fracture, or diabetes). Covariates were selected based on clinical importance and previous disability and frailty research with Hispanic and non-Hispanic populations.[6,14–16] Surviving subjects who were lost at follow-up or who declined to be interviewed at follow-up were censored to the date of their last completed interview. Analyses were conducted using SPSS version 14.0 (Chicago, IL).

Results

Table 1 shows the study sample demographic and health characteristics for men and women, stratified by survival status. Of those who died, 469 (40%) were women and 423 (51%) were men. On average, men and women who died during the 10 years of the study period were older, not married, weaker, slower, and less physically active compared with those who survived. In addition, mortality in both sexes was related to lower BMI, a higher prevalence of cancer and diabetes, and frailty. Among women only, ≥12 years of education was protective of mortality, whereas prior stroke was associated with more deaths. In men, history of smoking, hypertension, and hip fracture were associated with more deaths.

The percentages within each frailty category for women and men, respectively, for the total sample were as follows: nonfrail (44.6% vs. 45.3%), prefrail (48.3% vs. 46.0%), and frail (7.1% vs. 8.7%). The distribution of frailty categories by age and sex was not statistically significant ($p = 0.34$). Table 2 shows the HRs for each of the frailty items by sex. Results show low physical activity as the stronger predictor of mortality in women, whereas slow walking speed showed the

Table 1. Study Sample Characteristics: Mean (SD) or Percentage

	Women			*Men*		
	Survived (n = 699) (59.8%)	*Died (n = 469) (40.2%)*	p *value*	*Survived (n = 405) (48.9%)*	*Died (n = 423) (51.1%)*	p *value*
Age, years	72.84 (4.99)	77.10 (6.72)	<0.001	72.25 (4.47)	76.49 (6.50)	<0.001
Married	45.4%	29.9%	<0.001	81.7%	69.7%	<0.001
Education, years						
0–5	61.0%	62.5%	0.055	60.2%	62.6%	0.192
6–11	28.7%	30.4%	0.471	27.6%	28.3%	0.838
12+	10.3%	7.1%	0.032	12.3%	9.1%	0.083
BMI, kg/m^2	29.24 (5.46)	28.15 (6.16)	0.002	27.50 (3.83)	26.50 (4.53)	0.001
Smoker	7.0%	6.8%	0.902	15.3%	21.0%	0.033
Heart attack	6.5%	8.1%	0.278	9.7%	13.2%	0.106
Stroke	4.7%	10.4%	<0.001	5.7%	8.5%	0.113
Hypertension	49.6%	54.6%	0.096	30.8%	44.2%	<0.001
Cancer	5.7%	9.6%	0.012	2.2%	8.1%	<0.001
Hip fracture	0.9%	2.1%	0.067	0.5%	2.1%	0.040
Diabetes	25.2%	32.8%	0.004	20.3%	35.5%	<0.001
Grip strength, kg	20.19 (4.99)	17.96 (5.38)	<0.001	32.92 (7.20)	28.52 (7.57)	<0.001
Walk time, sec	8.75 (3.74)	10.63 (6.29)	<0.001	7.47 (3.21)	9.11 (4.24)	<0.001
PASE	91.56 (51.96)	66.70 (54.51)	<0.001	125.47 (66.75)	91.70 (70.71)	<0.001
Frailty categories						
Nonfrail	51.5%	34.3%	<0.001	58.0%	33.1%	<0.001
Prefrail	46.1%	51.6%	0.064	40.2%	51.5%	0.001
Frail	2.4%	14.1%	<0.001	1.7%	15.4%	<0.001

strongest association in men. For either sex, lost weight was the only item that did not reach statistical significance.

To evaluate the frailty-related HRs for mortality over the 10 years, we developed four sets of survival models. Table 3 shows separate Cox proportional HRs for women and men. The full-adjusted models (models 2 and 4) show the increased HR of death among frail women compared with frail men. Frail women were nearly twice as likely to die (HR 1.92; 95% confidence interval [CI] 1.39-2.65) over the 10-year study period compared with nonfrail women. Frail men demonstrated more than three times the risk for death (HR 3.04; 95% CI 2.16-4.28) compared with nonfrail men over the same time period.

Discussion

The current study assessed the association between frailty and 10-year mortality risk in older men and women of Mexican American origin. Results showed an association between frailty and increased mortality risk among both men and women; however, the impact of frailty on mortality was stronger among men after adjusting for potentially confounding variables, such as age, marital status, education, BMI, health behaviors, and medical conditions.

Table 2. Hazard Ratios Models of Frailty Components by Sex ($N = 1996$)

	Women[a] *(n = 1668)*		*Men*[a] *(n = 828)*	
	HR	*95% CI*	*HR*	*95% CI*
Weight loss	1.14	0.89-1.45	1.21	0.94-1.55
Exhaustion	1.50	1.18-1.91	1.41	1.07-1.85
Walking speed	1.52	1.22-1.91	1.77	1.38-2.26
Grip strength	1.33	1.07-1.65	1.56	1.23-1.98
Physical activity	1.79	1.42-2.26	1.59	1.26-2.02

[a]Models adjusted for age, marital status, education, BMI, smoking status, and medical conditions.

Previous research examining the association between frailty, as defined by Fried et al.,[6] and mortality reports similar results. Ensrud et al.,[10] using data from the Study of Osteoporotic Fractures, found frailty independently associated with increased risk of falls, fractures, and mortality among older women and found that the association was even more evident for women aged ≥80 years than for older women in the younger groups. Cawthon et al.,[17] also found frail community-dwelling older men at risk for poor health outcomes and mortality; however, contrary to the Ensrud study,[10] Cawthon et al. found that the association between frailty and mortality was stronger in the younger groups vs. the older men group.

The results of this study are in agreement with previous studies; however, this investigation suggests that the magnitude of the independent association between frailty and risk of mortality is greater among frail men than among frail women. Our findings differ from those of an earlier study by Puts et al.,[12] who found greater HRs for mortality in frail women compared with frail men living in the Netherlands. This discrepancy in results could be attributed to differences in the components of the frailty measure used or the criteria to categorize the frailty scores. Puts et al.,[12] studied static and dynamic frailty using a 9-item composite measure that included peak respiratory flow, cognition, vision, hearing, incontinence, and sense of mastery. Although physical activity and change in body weight were included in both studies, their frailty measure did not include measures of grip strength or walking speed and did not use gender-specific cutoff points.

Our results show the predictive validity of the frailty measure, as defined by Fried et al.,[6] and mortality in the older

Table 3. Mortality Hazard Ratio Models for Older Mexican American Women and Men

	Women (n = *1168*)				*Men* (n = *828*)			
	Model 1		*Model 2*		*Model 3*		*Model 4*	
	HR	*95% CI*	*HR*	*95% CI*	*HR*	*95% CI*	*HR*	*95% CI*
Nonfrail	1.00		1.00		1.00		1.00	
Prefrail	1.36	1.10-1.67	1.29	1.05-1.60	1.58	1.27-1.97	1.46	1.17-1.83
Frail	2.17	1.59-2.97	1.92	1.39-2.65	3.56	2.56-4.94	3.04	2.16-4.28
Age, years	1.07	1.05-1.08	1.07	1.05-1.09	1.06	1.05-1.08	1.06	1.05-1.08
Married	0.87	0.70-1.08	0.92	0.74-1.14	0.74	0.59-0.92	0.74	0.60-0.93
Education								
0–5 years	1.00		1.00		1.00		1.00	
6–11 years	1.16	0.94-1.42	1.11	0.90-1.37	1.21	0.97-1.51	1.12	0.89-1.42
12+ years	1.05	0.72-1.52	1.01	0.69-1.47	1.29	0.91-1.83	1.10	0.77-1.58
BMI			0.98	0.97-1.00			0.97	0.95-0.99
Smoker			1.30	0.88-1.92			1.31	1.01-1.70
Heart attack			0.99	0.68-1.43			0.91	0.67-1.23
Stroke			1.47	1.07-2.02			1.20	0.84-1.71
Hypertension			1.26	1.03-1.53			1.41	1.14-1.75
Cancer			1.30	0.94-1.81			1.87	1.26-2.77
Hip fracture			1.65	0.81-3.37			0.91	0.45-1.83
Diabetes			1.30	1.05-1.61			1.80	1.46-2.22
Age* prefrail			1.03	1.00-1.07			1.00	0.96-1.04
Age* frail			0.99	0.95-1.04			0.96	0.91-1.01

*Interaction terms.

adult independent of demographic factors and chronic disease. Nevertheless, the possibility that frailty could be a marker of other underlying etiological disorders[14] or be associated with social and environmental factors[18] that can potentially increase the risk of mortality cannot be ruled out. Emerging frailty research is beginning to steer the focus to a more holistic approach that includes not only individual factors, such as biological and medical factors, but also the broader environment.[18] This multidimensional approach includes socioeconomic factors, lifestyle, and social and psychological issues that may expand the understanding of frailty and lead to the development of successful intervention programs in the older frail adult.[18–20]

The greater survival of women over men has often been reported in the general literature. Arguments pointing to the survival advantage of women suggest that women are better able to deal with the consequences of morbidity.[21] Although women tend to live longer, they do not live a disease-free life. The detriments of poorer health and disability seem to be shielded by women's social patterns of support. It is well documented that women enjoy larger social networks and more close social ties than men. Whereas men are more likely to receive high levels of social support from their spouses, they are far less likely to receive support from other sources, such as relatives and friends.[22] Taken together, studies on culture and gender-specific patterns of socialization indicate that men are less willing to admit needing support, are less willing than women to accept offered support, and are less assertive than women in seeking support.[23,24]

The current study has several limitations. First, the information in the HEPESE concerning health conditions and comorbidities was obtained by self-reports; however, studies examining the degree of bias associated with self-report measures compared with routine physician examinations in older persons show good agreement between self-reported medical conditions and actual medical diagnoses.[25,26] Second, our sample excluded people whose interview was completed by proxy, those who had missing data on any of the components of the frailty measure, and those who were admitted to a nursing home or other institutional care. People eliminated were older and had more comorbidities and activity of daily living limitations and lower Mini Mental State Examination (MMSE) scores. Thus, people who remained in the study represented the healthiest members of the original sample.

This study has several strengths, including the large community-based sample involving participants who share particular demographic and social characteristics and the prospective nature of the data collection, extending to 10 years of follow-up.

Conclusions

Taken together, the current study showed the usefulness of the five-item frailty measure in predicting risk of mortality over 10 years in a sample of community-dwelling older adults. To our knowledge, this is the first study that examines frailty and risk of mortality by sex in an older sample of the largest growing minority population in the United States. With an estimate growth rate of 38% by the year 2020,[27] the rapid growth in the number and proportion of older Mexican Americas in the United States raises key issues about their health-related quality of life. Additional research could explore sex-specific effects of change in frail status over time and how this change, positive or negative, may serve as a protective factor or as the precursor of mortality.

Acknowledgments

This research was supported by funding from the National Institutes of Child Health and Human Development for I.M.B.

(R03HD058216-01 and K12-HD052023) and the National Institute of Aging for G.V.O. (ROI-A6024806) and K.J.O. (K02-AG019736).

Disclosure Statement

The authors have no conflicts of interest to report.

References

1. Raphael D, Cava M, Brown I. Frailty: A public health perspective. Can J Public Health 1995;86:224–227.
2. Bergman H, Ferrucci L, Guralnik J, et al. Frailty: An emerging research and clinical paradigm—Issues and controversies. J Gerontol A Biol Sci Med Sci 2007;62:731–737.
3. Hogan DB, MacKnight C, Bergman H, Steering committee, Canadian Initiative on Frailty and Aging. Models, definitions, and criteria of frailty. Aging Clin Exp Res 2003;15 (Suppl 3):1–29.
4. Strandberg TE, Pitkala KH. Frailty in elderly people. Lancet 2007;369:1328–1329.
5. Graham JE, Alsnih S, Berges I-M, Ray LA, Markides KS, Ottenbacher KJ, Frailty and 10 year mortality in community living Mexican american older adults. In press. Gerontology.
6. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: Evidence for a phenotype. J Gerontol A Biol Sci Med Sci 2001;56:M146–M156.
7. Rockwood K, Hogan DB, MacKnight C. Conceptualisation and measurement of frailty in elderly people. Drugs Aging 2000;17:295–302.
8. Dunlop DD, Song J, Manheim LM, Chang RW. Racial disparities in joint replacement use among older adults. Med Care 2003;41:288–298.
9. Gornick ME, Eggers PW, Reilly TW, et al. Effects of race and income on mortality and use of services among Medicare beneficiaries. N Engl J Med 1996;335:791–799.
10. Ensrud KE, Ewing SK, Taylor BC, et al. Frailty and risk of falls, fracture, and mortality in older women: The Study of Osteoporotic Fractures. J Gerontol A Biol Sci Med Sci 2007; 62:744–751.
11. Walston J, Fried LP. Frailty and the older man. Med Clin North Am 1999;83:1173–1194.
12. Puts MT, Lips P, Deeg DJ. Sex differences in the risk of frailty for mortality independent of disability and chronic diseases. J Am Geriatr Soc 2005;53:40–47.
13. Washburn RA, Smith KW, Jette AM, Janney CA. The Physical Activity Scale for the Elderly (PASE): Development and evaluation. J Clin Epidemiol 1993;46:153–162.
14. Gill TM, Gahbauer EA, Allore HG, Han L. Transitions between frailty states among community-living older persons. Arch Intern Med 2006;166:418–423.
15. Ostir GV, Ottenbacher KJ, Markides KS. Onset of frailty in older adults and the protective role of positive affect. Psychol Aging 2004;19:402–408.
16. Ottenbacher KJ, Ostir GV, Peek MK, Snih SA, Raji MA, Markides KS. Frailty in older Mexican Americans. J Am Geriatr Soc 2005;53:1524–1531.
17. Cawthon PM, Marshall LM, Michael Y, et al. Frailty in older men: Prevalence, progression, and relationship with mortality. J Am Geriatr Soc 2007;55:1216–1223.
18. Woo J, Goggins W, Ho SC. Social determinants of frailty. Gerontology 2005;51:402–408.
19. Fisher A. Just what defines frailty? J Am Geriatr Soc 2005; 53:2229–2230.
20. Mitnitski A, Song X, Skoog I, et al. Relative fitness and frailty of elderly men and women in developed countries. J Am Geriatr Soc 2005;53:2184–2189.
21. Perenboom RJM, Van Herten LM, Boshuizen HC, Van Den Bos GAM. Life expectancy without chronic morbidity: Trends in gender and socioeconomic disparities. Public Health Rep 2005;120:46–54.
22. Suitor JJ, Pillemer K. Gender, social support, and experiential similarity during chronic stress: The case of family caregivers. In: Levy JA, Pescosolido BA, eds. Social networks and health. Oxford, U.K.: Elsevier, 2002:247–266.
23. Dunkel-Shetter C, Skokan LA. Determinants of social support provision in personal relationships. J Soc Pers Rel 1990;7:437–450.
24. Riggio RE, Zimmerman J. Social skills and interpersonal relationships: Influences on social support seeking. In: Jones WH, ed. Advances in personal relationships. London: Jessica Kingsley, 1981:133–155.
25. Hughes SL, Edelman P, Naughton B, et al. Estimates and determinants of valid self-reports of musculoskeletal disease in the elderly. J Aging Health 1993;5:244–263.
26. Okura Y, Urban LH, Mahoney DW, Jacobsen SJ, Rodeheffer RJ. Agreement between self-report questionnaires and medical record data was substantial for diabetes, hypertension, myocardial infarction and stroke but not for heart failure. J Clin Epidemiol 2004;57:1096–1103.
27. Day JC. Population projections of the United States, by age, sex, race, and Hispanic origin: 1995 to 2050. Washington, DC: U.S. Department of Commerce, Bureau of the Census, 1996. Publication P25–1130.

Address correspondence to:
Ivonne-Marie Berges, Ph.D.
Assistant Professor
301 University Boulevard
University of Texas Medical Branch
Galveston, TX 77555-0460

E-mail: imberges@utmb.edu