Published in final edited form as:

Pain. 2020 January ; 161(1): 109–113. doi:10.1097/j.pain.0000000000001711.

Pain as a predictor of frailty over time among older Mexican Americans

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Abstract

The objective of this study was to examine pain as a predictor of frailty over 18 years of follow-up among older Mexican Americans who were non-frail at baseline. Data were from a prospective cohort study of 1,545 community-dwelling Mexican Americans aged 67 years from the Hispanic Established Populations for the Epidemiological Study of the Elderly (1995/96 to 2012/13). Frailty was defined as meeting two or more of the following: unintentional weight loss of >10 pounds, weakness, self-reported exhaustion and slowness. The independent predictor was self-reported pain. Covariates included age, gender, marital status, education, comorbid conditions, body mass index, Mini Mental State Examination (MMSE), depressive symptoms and limitation in activities of daily living (ADLs). General Equation Estimation was performed to estimate the odds ratio of frailty as a function of pain. A total of 538 participants (34.8%) reported pain at baseline. The prevalence of frailty among those with pain ranged from 24.4% in wave 3 to 41% in wave 8. The odds ratio of becoming frail over time as a function of pain was 1.71; 95% Confidence Interval: 1.41–2.09 after controlling for all covariates. Older age, hip fracture, high depressive symptoms and ADL disability were also associated with higher odds of becoming frail over time. Female participants and those with higher levels of education and high MMSE scores were less at risk. In conclusion, pain was significantly associated with frailty. Early assessment and better management of pain may prevent early onset of frailty in older Mexican Americans.

1. Introduction

Pain is defined as a “an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.”³⁶ Pain is one of the most prevalent and expensive medical problem in the US, with an estimated 100 million

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Conflict of Interest statement

The authors have no conflict of interest to declare.

Americans living with some level of pain, more than the estimates affected by cancer, heart disease and diabetes.^{16,18} Although each individual experiences pain at some point, older adults are in general at a higher risk of suffering from chronic pain.²³ Musculoskeletal pain is associated with decreased quality of life and restrictions in activities of daily living (ADLs), instrumental activities of daily living (IADLs) and mobility.^{11,13,23} Studies have shown that the prevalence of pain ranges from 24% to 72% among older adults, with highest prevalence in Non-Hispanic whites (31%) compared to Non-Hispanics blacks (26%) and Hispanics (18%).^{6,34}

Hispanics are the fastest growing group of older adults in the US, with older Mexican Americans the largest segment of US Hispanics (65%).^{1,2} Older Mexican Americans are unique for several reasons. First, they have the highest prevalence of diabetes, obesity and disability, all risk factors associated with pain syndromes.^{4,17,28} Second, they have poor access to medical care for various conditions (e.g., arthritis and diabetes) associated with pain.³⁰ Third, the high level of low health literacy affects their ability to manage complex comorbidities in the face of a changing US health care system.³⁷

Frailty is defined as “a physiologic state of increased vulnerability to stressors that results from decreased physiologic reserves, and even dysregulation, of multiple physiologic systems.”¹⁵ Frailty is highly prevalent in older adults and is associated with several adverse health outcomes, including disability, cognitive decline, institutionalization and mortality.¹⁵ Research has shown pain as a risk factor for frailty among older adults.^{26,35,38–40} Most of these studies that have investigated the relationship between pain and frailty are of cross-sectional design^{10,35,38} or systematic reviews, with few longitudinal studies, mostly in non-Hispanic populations.^{26,32,39,40} For example, Megale and colleagues using participants from the Concord Health and Ageing in Men Project (CHAMP) found that, after 5 years, those with chronic pain were at 1.6 times greater risk of becoming frail than those without pain.²⁶ Wade and colleagues using participants from the English Longitudinal Study of Ageing (ELSA) found that those with severe pain were four times more likely to become frail after 8 years of follow up.⁴⁰

Although previous studies show a relationship between pain and frailty, these studies were conducted mostly in men, Non-Hispanic populations, and had less than 10-year follow-up. Little is known about the effect of pain and the long-term risk of becoming frail among older Mexican Americans, a population with high rates of frailty. Therefore, the objective of this study was to examine pain as a predictor of frailty over 18 years of follow-up among older Mexican Americans who were non-frail at baseline.

2. Methods

2.1. Data Source and Study Sample

The data came from the Hispanic Established Populations for the Epidemiological Study of the Elderly (EPESE), an ongoing longitudinal study of 3,050 Mexican Americans aged 65 years and above residing in five Southwestern states of U.S. Information of the Hispanic EPESE (survey instrument, definition of variables, and the de-identified raw data) are available at the National Archive of Computerized Data on Aging at the University of

Michigan.³ This study used data collected from wave 2 (1995/96) to wave 8 (2012/13). The baseline interview information was used to assess weight loss (a component of the frailty phenotype) as the difference between weight measured in 1993–94 (baseline) and weight measured in 1995–96 (wave 2). Of the 2,438 interviewed at Wave 2 (hereafter referred as baseline), 974 (51.4%) were non-frail, 622 (32.8%) pre-frail, and 299 (15.8%) frail. We excluded 299 participants who were frail and 594 with missing information for any of the covariates. The final sample included 1,545 older Mexican Americans aged 67 years (Figure 1). Participants excluded from the study were significantly more likely to be older; to report a heart attack, stroke, cancer or hip fracture; to have body mass index (BMI) mean of 24 Kg/m²; to have a mean Mini-Mental-State-Examination (MMSE) score of 21; and to report one or more limitations in ADLs compared to participants included in the study. At the end of follow up (2012/13), 245 participants were re-interviewed in person, 82 via proxy, 15 refused to be re-interviewed, 134 were lost to follow up and 1,069 were confirmed dead through the NDI and reports from relatives. Figure 1 shows the number of death and refused/lost to follow-up participants at each wave of interview. The study and all research protocols were approved by the Institutional Review Board.

2.2. Measures

2.2.1. Pain—Pain was assessed from the response to the question: “In the past month, have you experienced pain or discomfort when you stood or walked?” Responses were coded as “Yes” or “No” at each wave.

2.2.2. Modified Frailty Phenotype—Frailty was assessed based on the modified Frailty Phenotype described by Fried et al.,¹⁵ because not all eight Waves of the Hispanic EPESE survey collected data on physical activity. The physical activity information was collected only at Wave 2 due to a shift in the Hispanic EPESE study objectives over time. Four frailty items were used: unintentional weight loss of >10 pounds, weakness, exhaustion and slowness.⁵

2.2.3. Covariates—Sociodemographic variables included age, gender, marital status and years of formal education. Medical conditions were assessed by self-reports of diabetes mellitus, heart attack, stroke, hypertension, arthritis, hip fracture or cancer. BMI was calculated dividing weight in kilograms by height in meters squared (Kg/m²). Cognitive function was assessed with the MMSE.¹⁴ Depressive symptoms was assessed with the CES-D scale.^{9,31} Disability was assessed using 7 items from a modified version of the Katz ADL scale.²⁰

2.3. Statistical Analysis

Chi-square and t-test were used to describe the sample characteristics by pain. General Equation Estimation using the GENMOD procedure in SAS was used to estimate the odds ratio (OR) of becoming frail over time (per year of follow-up) as a function of pain, controlling for socio-demographics, medical conditions, cognitive function, BMI, depressive symptoms and ADL disability. Except for education and gender, all variables were analyzed as time-varying. Participants who were lost to follow up, refused or died were included in the study until their last interview date for the 18 years of follow up. Additional analysis

excluded those who were pre-frail or frail at baseline. All analyses were performed using SAS, version 9.4 (SAS Institute, Inc., Cary NC).

3. Results

At baseline/Wave 2 (n=1,545), the average age of the participants was 74.3 years (SD=5.6), 58.4% were female, and 54.6% were married. The mean formal years of education was 5.0 (SD=3.9) and the BMI mean was 28.1 (SD=5.1). A total of 538 (34.8%) participants reported pain. The most prevalent medical conditions were hypertension (44.8%), arthritis (42.4 %) and diabetes (26%). The prevalence of frailty among those with pain ranged from 24.4% in wave 3 to 41% in wave 8 (Figure 2).

Table 1 presents the baseline descriptive characteristics of the sample by pain status of those who were not frail at baseline (n=1,545). Participants who reported pain were significantly more likely to be female (66%), to have higher BMI (29.3 Kg/m²), to report more arthritis (74.4%), hypertension (52.8%), high depressive symptoms (13.8%) and ADL disability (4%) compared to those without pain.

Table 2 presents the results of the General Estimation Equation model of becoming frail over 18 years of follow up as a function of pain, controlling for socio-demographics, comorbid conditions (diabetes mellitus, heart attack, stroke, hypertension, arthritis, hip fracture and cancer), cognitive function, BMI, depressive symptoms and ADL disability. Over time, the odds of becoming frail was 1.04 [95% confidence interval (CI)=1.01–1.07]. Participants reporting pain had 1.71 (95% CI=1.41–2.09) higher odds of becoming frail over time after controlling for all covariates. Other factors associated with significantly higher odds of becoming frail were older age (OR=1.05; 95% CI= 1.02–1.07), hip fracture (OR= 2.41; 95% CI=1.29–4.49), high depressive symptoms (OR=1.08; 95% CI=1.06–1.09) and ADL disability (OR=2.59; 95% CI=2.06–3.25). Female participants (OR=0.78; 95% CI=0.62–0.97), those with higher levels of education (OR=0.97; 95% CI=0.95–0.99) and those with high MMSE score (OR=0.98; 95% CI=0.96–0.99) were less likely to become frail over time. When we excluded those who were pre-frail or frail at baseline, the odds of becoming frail as a function of pain was 1.61 (95% CI=1.26–2.08) after controlling for all covariates.

4. Discussion

The current study examined whether pain in older Mexican Americans is a risk factor for frailty among those who were non-frail at baseline. Our findings showed that those who reported pain were 1.7 times more likely to become frail over 18 years of follow up, after controlling for all covariates. Older age, hip fracture, high depressive symptoms and ADL disability were also associated with higher odds of becoming frail over time. Female participants, those with higher levels of education and those with a high MMSE score were less likely to become frail over time.

The findings of this study are similar to those from the CHAMP and EMAS studies.^{26,39} Participants in the CHAMP study who reported pain were 1.6 times more likely to develop frailty over 2 years of follow up.²⁶ Participants in the EMAS study who reported some pain and those who reported chronic widespread pain were 1.5 and 4.3 times more likely,

respectively, to become frail after 4 years of follow up.³⁹ However, our findings differ from those reported in the ELSA study, where those with moderate pain and severe pain were 3.1 and 3.8 times more likely, respectively, to become frail over time.⁴⁰

Our study included several important differences from previous research examining the relationship between pain and frailty. We found that the percent of older Mexican Americans with pain-associated frailty increased from 24.4% in 1995/96 to 41% in 2012/13. This increase is concerning and the reasons for it are unclear. This finding suggests a need to develop policies to increase access to culturally appropriate interventions for optimal management of common conditions (e.g., diabetes, arthritis, and depression) associated with pain in this population. With the recent federal rule restricting prescribing of opioid analgesics, there is a need to facilitate access of those living with pain to evidence-based non-opioid modalities like physical therapy, occupational therapy, joint injections and integrative care.¹² The most important difference our study and previous reports is that ours include a large population-based sample of older Mexican Americans, an underserved group with unique risk factors related to health care access, delivery and outcomes in the US healthcare system.³⁰ Our study involved a longer follow-up period (18 years) than previous investigations and included both male and female participants who were non-frail at baseline.

The association between pain and frailty can be explained by mechanisms that underlie both conditions. It has been shown that pain is associated with weak grip strength,²² reduced gait speed²⁹ and malnutrition,⁸ all components of the frailty phenotype.¹⁵ Persistent pain acts as a stressor by triggering the stress mechanism and diminishing physiologic reserves, in turn increasing the risk of developing frailty.^{10,19,33} Previous studies have suggested that pain may lead to alterations in the hypothalamic-pituitary-adrenal axis and cellular inflammation that can potentially predisposes the individual to frailty.^{21,24} Additionally, older adults are vulnerable to musculoskeletal pain due to progressive age-related pathological changes that impair their ability to cope with pain and eventually predisposes them to a greater risk of adverse health outcomes, comorbidities, functional impairment, disability and frailty.^{7,27,41} Prevention and early treatment may reduce the burden of pain and potentially delay the onset of frailty in this population.

Our study has some limitations. First, pain and comorbid conditions were assessed through self-reports. This may lead to recall bias as compared to physician assessment. However, self-reported data for pain have been shown to be robust, particularly for dichotomous measures such as pain versus no pain.²⁵ Second, not including the physical activity criterion as a part of the frailty phenotype measure could have underestimated the rate of frailty. Third, participants excluded from the study were less healthy compared to those included, which might have underestimated the relationship between pain and frailty. Fourth, the subjects who died before wave 2 may have produced a survival bias. Fifth, we do not have information on pain duration, pain intensity or pain treatment. Finally, our findings are not generalizable to the larger Hispanic population in the US. This study has several strengths, including its longitudinal design, the inclusion of socio-demographics and medical conditions as time varying, the length of follow up and a focus on a disadvantaged and underserved population.

In conclusion, our study establishes that non-frail older Mexican Americans with pain are more likely to experience frailty over time than those without pain. This effect persisted after controlling for demographics and health characteristics. Our findings suggest that early assessment and proper management of pain may reduce frailty and improve the quality of life in this at-risk and underserved population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

This work was supported by the National Institute on Aging, the National Institute on Minority Health and Health Disparities, Texas Resource Center on Minority Aging Research, and the National Center for Medical Rehabilitation Research in the National Institute of Child Health and Human Development in the National Institutes of Health (R01 AG10939, R01 AG017638, 1P30 AG059301-01, K01 HD086290, and R01 MD010355). The authors acknowledge the assistance of Sarah Toombs Smith, PhD, ELS, in article preparation. Dr. Toombs Smith received no compensation for this effort beyond her salary at the UTMB Sealy Center on Aging.

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Figure 1.
Flow Chart of Selection of the Study Population.

Figure 2.
Percentage of Frailty by Pain over Time among Non-Frail Older Mexican Americans at Baseline (n=1,545).

Table 1.

Sample Characteristics at Baseline by Pain Status among Non-Frail Older Mexican Americans (n=1,545).

Predictor variables	No pain N (%)	Pain N (%)	p-Value
Total	1007 (65.2)	538 (34.8)	
Age (Mean $\pm$ SD)	74.4 $\pm$ 5.73	74.1 $\pm$ 5.44	0.170
Gender (Female)	547 (54.3)	355 (66.0)	<0.0001
Married (Mean $\pm$ SD)	562 (55.8)	281 (52.2)	0.181
Education, years (Mean $\pm$ SD)	5.24 $\pm$ 4.0	4.66 $\pm$ 3.8	0.108
BMI (Mean $\pm$ SD)	27.4 $\pm$ 4.8	29.3 $\pm$ 5.4	0.002
MMSE (Mean $\pm$ SD)	24.6 $\pm$ 4.2	24.1 $\pm$ 4.1	0.473
Arthritis	256 (25.4)	400 (74.3)	<0.0001
Hypertension	409 (40.6)	284 (53.0)	<0.0001
Stroke	56 (5.6)	35 (6.5)	0.496
Diabetes	256 (25.4)	146 (27.1)	0.466
Cancer	53 (5.3)	35 (6.5)	0.357
Heart attack	73 (7.3)	51 (9.5)	0.140
Hip Fracture	8 (0.8)	5 (0.9)	0.776
Depression	48 (4.7)	74 (13.8)	<0.0001
ADL Disability	20 (2.0)	22 (4.1)	0.020

Abbreviations: SD (Standard Deviation), BMI (Body Mass Index), MMSE (Mini Mental state Examination), ADL (Activities of Daily Living).

Table 2.

General Estimation Equations for Becoming Frail over 18-years of Follow-up as a Function of Pain among Non-Frail Older Mexican Americans at Baseline (n=1,545).

Predictor variables	OR (95% CI)	P-Value
Time (Years)	1.04 (1.01–1.07)	0.005
Pain	1.71 (1.41–2.09)	<0.0001
Age	1.05 (1.02–1.07)	<0.0001
Gender (Female)	0.78 (0.62–0.97)	0.028
Married	1.11 (0.89–1.38)	0.328
Education (years)	0.97 (0.95–0.99)	0.027
BMI	0.98 (0.96–1.00)	0.084
MMSE	0.98 (0.96–0.99)	0.048
Arthritis	0.95 (0.78–1.17)	0.628
Hypertension	0.95 (0.78–1.16)	0.621
Stroke	0.83 (0.52–1.32)	0.429
Diabetes	1.15 (0.93–1.42)	0.209
Cancer	1.29 (0.90–1.84)	0.166
Heart attack	1.30 (0.90–1.87)	0.157
Hip Fracture	2.41 (1.29–4.49)	0.005
Depression	1.08 (1.06–1.09)	<0.0001
ADL Disability	2.59 (2.06–3.25)	<0.0001

Abbreviations: OR (Odds ratio), CI (Confidence Interval), BMI (Body Mass Index), MMSE (Mini Mental state Examination), ADL (Activities of Daily Living).