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Frailty in Older American Indians: The Native Elder Care Study

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Abstract

Introduction: Frailty is often described as a reduction in energy reserves, especially with respect to physical ability and endurance, and it has not been examined in American Indians. The goals of this study were to estimate the prevalence of frailty and identify its correlates in a sample of American Indians. **Methods:** We examined data from 411 community-dwelling American Indians aged ≥55 years. Frailty was measured with weight loss, exhaustion, low energy expenditure, slowness, and weakness characteristics. **Results:** Slightly over 44% of participants were classified as pre-frail and 2.9% as frail. Significant correlates of a combined pre-frail and frail status identified in the fully adjusted analyses were younger age, female gender, lower levels of education, increased number of chronic medical conditions, and increased number of activities of daily living limitations. Marital status, chronic pain, and social support were not associated with pre-frail/frail status. **Conclusions:** Our findings point to specific areas in need of further research, including use of frailty measures that also capture psychosocial components and examining constructs of physical resilience. Targeting those with multiple chronic medical conditions may be an important area in which to intervene, with the goal of reducing risk factors and preventing frailty onset.

Keywords
American Indians, frailty, pre-frailty, community-dwelling

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Introduction

With life expectancy in the United States at an all-time high for all racial and ethnic groups (Arias, Heron, & Xu, 2017), researchers and policy makers have shifted their attention from a strict focus on longevity to the equally important goal of increasing quality of life. Frailty is a clinical state or a syndrome where there is an increased vulnerability to biological decline in response to a stressor (Morley et al., 2013). Overall, frailty has been operationalized numerous ways in the research literature with two general approaches: either strictly physical or more broadly considering both the physical and the psychosocial aspects (Collard, Boter, Schoevers, & Oude Voshaar, 2012). There is no one definitive definition of frailty, but most of the research has relied on the strictly physical operationalization. Here, frailty includes reduced energy (Rockwood et al., 2005), reduced ability to regulate changes in physiologic systems, immunologic decay, low nutritional intake, and decreased physical activity (Bartali et al., 2006; Bortz, 2002; Fried, Ferrucci, Darer, Williamson, & Anderson, 2004). Regardless of its operationalization, the consequences of frailty extend beyond the physical domains to psychosocial domains (Gobbens, Luijkx, Wijnen-Sponselee, & Schols, 2010). Being frail can often lead to a variety of adverse outcomes, many of which lead to decreased functional ability and quality of life (Bilotta et al., 2010; Crews & Zavotka, 2006).

According to a systematic literature review, frailty prevalence in community-based samples varies from 4% to 59%, with 10.7% as the overall weighted prevalence of frailty for persons aged ≥65 years (Collard et al., 2012). Known demographic correlates of frailty include older age, female gender, living alone, and lower educational attainment (Al Snih et al., 2009; Chen, Wu, Chen, & Lue, 2010; Peek, Howrey, Ternent, Ray, & Ottenbacher, 2012; Pollack et al., 2017). Other correlates include low nutritional intake (Lo et al., 2017), decreased levels of social support (Peek et al., 2012), decreased physical activity (Bilotta et al., 2010), disability (Al Snih et al., 2009), increased number of chronic medical conditions (Afilalo, Karunananthan, Eisenberg,

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Alexander, & Bergman, 2009; Chen et al., 2010), institutionalization (Bandeen-Roche et al., 2006), and mortality (Bandeen-Roche et al., 2006; García-González, García-Peña, Franco-Marina, & Gutiérrez-Robledo, 2009). Frailty can have both immediate and progressive effects on the aging process, from exacerbating current disabilities to causing a gradual loss of endurance (Fried et al., 2004; Pel-Littel, Schuurmans, Emmelot-Vonk, & Verhaar, 2009).

Although frailty has been measured in Asian, Hispanic, and other racial and ethnic populations (Al Snih et al., 2009; Chen et al., 2010; Hirsch et al., 2006), it has not been examined in American Indians. Obtaining a complete understanding of the factors that may negatively affect quality of life in American Indians is important particularly given that those aged ≥65 years are projected to more than triple from 464,000 in 2012 to 1,624,000 in 2050 (Ortman, Velkoff, & Hogan, 2014). Older American Indians also suffer higher prevalence rates of major chronic conditions such as type 2 diabetes mellitus and hypertension (Goins & Pilkerton, 2010) and have the lowest life expectancy than other race or ethnic groups (Sancar, Abbasi, & Bucher, 2018). Thus, the purpose of our study was to estimate the prevalence of frailty and identify its correlates in a community-based sample of American Indians aged ≥55 years.

Method

Data Source

Data for this analysis were collected as part of the Native Elder Care Study, a cross-sectional study of community-dwelling members of a federally recognized American Indian tribe in the Southeast region of the United States. The study gathered in-depth information via interviewer-administered surveys on lower body functioning, disability, personal assistance needs, mental and physical health conditions, psychosocial resources, and use of health care and supportive services. Data were collected between July 2006 and August 2008. To be included in the study, participants had to be an enrolled tribal member, aged ≥55 years, noninstitutionalized, cognitively intact, and reside in the tribe's service area. A lower age criterion was used because research suggests that American Indians are more likely to experience greater chronic disease burden and subsequent health declines with age compared with other racial/ethnic groups (Barnes, Adams, & Powell-Griner, 2010). In addition, many American Indian communities, including the tribe which participated in this study, consider elders as those aged ≥55 years.

Tribal enrollment records indicated that there were 1,430 potentially eligible adults based on age and residential location. From this list, a random sample of 680 adults was drawn, stratified by three age groups: 55 to 64, 65 to 74, and ≥75 years. Potentially eligible persons were invited to participate via a telephone call or a home visit by an interviewer. Forty-seven adults could not be located, 78 declined participation, and 50 were determined to be ineligible (three living outside of service area, 14 in a nursing home, 19 were deceased, 14 who did not pass the dementia screen). The remaining 505 participants received comprehensive in-person assessments conducted by trained interviewers that lasted between 60 and 90 min. Most interviews were conducted in the participant's home (87%), with the remaining conducted in a tribal building in a private location. Propensity to decline participation increased with age, although this was not significant, and men were more likely to decline than women ($p \leq .001$). The tribe's Institutional Review Board, Tribal Council, Tribal Elder Council, and West Virginia University Institutional Review Board approved the project. All study participants provided informed consent and received a US$20 gift card for completing the interview. More detail about the study's methodology is described elsewhere (Goins, Garroutte, Leading Fox, Geiger, & Manson, 2011).

Measures

Frailty. We used the strictly physical operationalization of frailty by replicating the frailty-defining criteria used with the Women's Health and Aging Studies (Bandeen-Roche et al., 2006) and the Cardiovascular Health Study (Fried et al., 2001). The measure includes five components: (a) weight loss, (b) exhaustion, (c) low energy expenditure, (d) slowness, and (e) weakness characteristics.

Weight loss was captured by a body mass index (BMI) which was calculated as measured weight in kilograms divided by measured height in meters squared. Those with BMI <18.5 kg/m^2 were classified as having weight loss. We relied on this measure as our data do not include an item that measured weight loss. However, the Women's Health and Aging Studies also used the same BMI cutoff as one of their indicators of weight loss (Bandeen-Roche et al., 2006), and other studies have relied on the same approach (Avila-Funes et al., 2008; Buttery, Busch, Gaertner, Scheidt-Nave, & Fuchs, 2015).

Exhaustion was measured if respondents gave the response option "most or all of the time" on "I felt everything I did was an effort" and/or "I could not get going," which are two items from the Center for Epidemiologic Studies–Depression Scale (Radloff, 1977). Low energy expenditure was determined by reporting no participation in physical activities during the past month. Slowness was determined by gait speed in meters per second (m/s) on a 4-m course, with a classification as "slow" based on participant height and gender: Females ≤62.60″ tall and males ≤68.11″ tall with a 4-m gait speed of ≤0.65 m/s were classified as slow, and females >62.60″ tall and males >68.11″ tall with a 4-m gait speed of ≤0.76 m/s were classified as slow.

Finally, weakness was determined based on participants' BMI and grip strength by gender. Females were categorized as weak if they had a BMI ≤23.0 and grip strength ≤17.0 lbs, a BMI between 23.1 and 26.0 and grip strength ≤17.3 lbs, a BMI between 26.1 and 29.0 and grip strength ≤18.0 lbs, or a BMI >29.0 and grip strength ≤21.0 lbs. Males were categorized as weak if they had a BMI ≤24.0 and grip strength ≤29.0 lbs, a BMI between 24.1 and 26.0 and grip strength ≤30.0 lbs, a BMI between 26.1 and 28.0 and grip strength ≤30.0 lbs, or a BMI >28.0 and grip strength ≤32.0 lbs.

The three classifications of frailty were defined as follows: Frailty status was classified as *robust* if the participant did not meet criteria for any of the components, *pre-frail* if the participant met criteria for one or two components, and *frail* if the participant met criteria for three to five components.

Correlates of frailty. Based on a review of existing literature, we selected potential correlates of frailty to examine, including demographic characteristics, chronic medical conditions, physical disability, chronic pain, and social support. Demographic characteristics included age (in years), gender (male or female), marital status, and educational attainment. Marital status was coded to indicate whether the respondent was married/had a life partner or other. Educational attainment was coded into three categories: ≤11 years, 12 years (high school diploma), and >12 years.

We assessed the total number of physician-diagnosed chronic medical conditions (Goins & Pilkerton, 2010; Rigler, Studenski, Wallace, Reker, & Duncan, 2002) including lung disease, arthritis, osteoporosis, Parkinson's disease, stroke, cancer, type 2 diabetes mellitus, hypertension, kidney disease, liver disease, and heart disease. Heart disease was indicated if any one of four heart-related conditions was reported: angina, congestive heart failure, heart attack, and heart disease. For the analyses, this measure was treated as a total count of these 11 medical conditions.

Physical disability was measured as the number of activities of daily living (ADLs) limitations that were reported from the following eight activities: bathing, dressing, eating, transferring, walking, toileting, grooming, and getting outside (Katz, 1983). Persons who indicated that they had some or a lot of difficulty performing each of these activities were coded as having a limitation in that activity. Those who indicated they did not do an activity because of a health or physical problem were also coded as having a limitation.

Chronic pain was assessed using the Chronic Pain Grade scale, a measure of chronic pain severity with the general population (Von Korff, Ormel, Keefe, & Dworkin, 1992). The measure consists of seven items, with three assessing pain intensity and four assessing disability. For our study, we omitted the fourth disability item that asked whether pain changed the respondent's ability to work over the past 6 months because the majority of participants reported that they did not work. This measure grades pain into four hierarchical classes, with Grade I indicating low disability/low intensity, Grade II indicating low disability/high intensity, Grade III indicating high disability/moderately limiting, and Grade IV indicating high disability/severely limiting.

The Medical Outcome Study Social Support Scale (MOS-SSS) was used to measure social support (Sherbourne & Stewart, 1991). The MOS-SSS is a 19-item scale with subscales that include the domains of emotional, informational, tangible, and positive interaction support and affectionate support. The scale ranges from 19 to 95, with higher scores indicating greater levels of social support. Participants were asked how often they received each of the 19 social support items when they needed it. This scale has been demonstrated with this study sample to have excellent psychometric properties with a Cronbach's alpha for the overall scale of .95 (Conte, Schure, & Goins, 2015).

Statistical Analyses

Descriptive statistics were used to examine sample characteristics and frailty. Individual responses were weighted to account for differential sampling rates across three age groups (55-64, 65-74, ≥75), with greater weights applied to the younger age categories. Chi-square tests were used to assess the bivariate association between frailty status and correlates. We used logistic regression to assess the adjusted odds of being classified as either pre-frail or frail, with robust as the index. The variance inflation factor was estimated to detect multicollinearity among the independent variables, which was not found to be an issue. Ninety-four participants who lacked complete data on our measure of frailty were excluded from the analyses, resulting in a final analytic sample of 411. Those who had missing data on the frailty measure did not differ significantly with respect to age and gender from those with complete frailty data. Multiple imputation was performed using the chained equations method to impute any missing data on the potential correlates (Royston & White, 2011). Data were imputed for three participants for marital status, two for chronic pain, and one for number of chronic medical conditions. All analyses used StataCorp statistical software package version 12.0 (Stata Statistical Software, 2007).

Results

Table 1 presents the definitions and sample prevalence for each of the five frailty components. Overall, we found that 52.8% of the participants were robust, 44.3% were pre-frail, and 2.9% were frail.

Table 2 shows the unadjusted association of frailty status with the demographic, chronic medical conditions, physical disability, chronic pain, and social support measures. We found frailty to be significantly associated with female gender, not being married or having a life partner, and having lower educational

Table 1. Criteria Definitions and Prevalence of Frailty Components.

Component	Definition	%
Weight loss	BMI <18.5 kg/m^2	1.4
Exhaustion	Self-reported most or all of the time frequency to either of the following CES-D items:	16.6
	(i) I felt everything I did was an effort	
	(ii) I could not get going	
Low energy expenditure	Self-reported no participation in physical activities during the past month	38.4
Slowness	Gait speed in meters per second (m/s) on a 4-m course	5.0
	For women:	
	≤0.65 m/s for height ≤62.60□	
	≤0.76 m/s for height >62.60□	
	For men:	
	≤0.65 m/s for height ≤ 68.11□	
	≤0.76 m/s for height > 68.11□	
Weakness	Grip strength	3.1
	For women:	
	≤17.0 lbs and BMI ≤23.0	
	≤17.3 lbs and BMI = (23.1-26.0)	
	≤18.0 lbs and BMI = (26.1-29.0)	
	≤21.0 lbs and BMI >29.0	
	For men:	
	≤29.0 lbs and BMI ≤24.0	
	≤30.0 lbs and BMI = (24.1-26.0)	
	≤30.0 lbs and BMI = (26.1-28.0)	
	≤21.0 lbs and BMI >29.0	
Frailty status	Robust (0 components)	52.8
	Pre-frail (1-2 components)	44.3
	Frail (≥3 components)	2.9

Note. Weighted percentages. BMI = body mass index; CES-D = Center for Epidemiologic Studies–Depression Scale.

attainment, increased number of chronic medical conditions and ADL limitations, greater chronic pain severity, and low levels of social support.

Table 3 presents results for the fully adjusted models of association between a pre-frail and frail classification with demographic, chronic medical conditions, physical disability, chronic pain, and social support measures. We found that participants with younger age, lower educational attainment, increased number of chronic medical conditions, and increased number of ADL limitations had significantly greater odds of being classified as either pre-frail or frail. Females had marginally significant greater odds of being classified as either pre-frail or frail than men ($p < .10$). Marital status, chronic pain severity, and social support were not significantly associated with pre-frailty/frailty classification after adjusting for the other covariates.

Discussion

The purpose of our study was to examine the prevalence of frailty and identify its correlates in a community-based sample of American Indians aged ≥55 years. The prevalence of frailty in our study sample of American Indians years was 2.9%, which is lower than what has been found in other community-based samples of adults aged ≥65 years, whereas the prevalence of pre-frailty in our sample was 44.3%, which is similar to what has been found in other samples (Collard et al., 2012).

One possibility of our relatively low prevalence of frailty may be due to the increased likelihood that those who were frail were more likely to decline participation. Research has shown that fatigue, morbidity, and physical disability are among the primary challenges in recruiting frail older adults into research studies (Provencher, Mortenson, Tanguay-Garneau, Belanger, & Dagenis, 2014). Yet, it is worth noting that our study protocol included an in-person interview at the location of the participant's choice to not exclude those who were frail or immobile. A second possible explanation of the relatively low frailty prevalence is that the high prevalence of obesity in our sample (56%) may have contributed where obesity provides a survival advantage. Another potential explanation may be due to the contribution of BMI to muscle mass in American Indians outweighing its contribution to the percentage of fat mass. Further research on the role of obesity on aging-related outcomes among American Indians is needed.

In the fully adjusted model, younger age, female gender, lower educational attainment, increased number of chronic medical conditions, and increased number of ADL limitations were correlated with being classified as either pre-frail or frail. Increased age and lower educational attainment have consistently been found as

Table 2. Unadjusted Association of Demographic and Health Characteristics With Frailty (*n* = 411).

	Frailty status (%)		
	Robust (*n* = 219)	Frail/Pre-frail (*n* = 192)	Unadjusted *p* value
Age			.113
55-64	50.0	50.0	
65-74	59.6	40.4	
≥75	48.2	51.8	
Gender			<.01
Female	48.1	51.9	
Male	60.2	39.7	
Marital status			<.01
Married/Life partner	60.1	39.4	
Other	46.7	53.3	
Education			<.001
<12 years	35.3	64.7	
12 years	48.8	51.2	
>12 years	72.7	27.3	
Count of chronic medical conditions			.001
0	66.9	33.1	
1-2	56.3	43.7	
3-4	47.9	52.1	
≥5	20.5	79.5	
Count of ADL limitations			<.001
0	63.5	36.5	
1-2	39.5	60.5	
3-4	32.8	67.2	
≥5	16.1	83.9	
Chronic pain grade			<.001
0 (pain free)	49.7	50.3	
1 (low disability/low intensity)	69.3	30.7	
2 (low disability/high intensity)	58.2	41.8	
3 (high disability/moderately limiting)	43.4	56.6	
4 (high disability/severely limiting)	17.8	82.2	
Social support			.01
Low	26.7	73.4	
Medium	48.7	51.3	
High	59.1	40.9	

Note. Weighted percentages. ADL = activities of daily living.

Table 3. Adjusted Association of Independent Variables With Frailty/Pre-Frailty (*n* = 411).

	OR	(95% CI)
Age	0.97	[0.94, 0.99]*
Female	1.47	[0.92, 2.39]†
Marital status	0.95	[0.58, 1.55]
Education	0.46	[0.34, 0.62]***
Count of chronic medical conditions	1.19	[1.01, 1.41]*
Count of ADL limitations	1.41	[1.09, 1.83]**
Chronic pain grade	0.97	[0.75, 1.25]
Social support	0.99	[0.97, 1.00]

Note. Robust is the referent category. OR = odds ratio; CI = confidence interval; ADL = activities of daily living.
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

significant correlates of frailty status in other race and ethnic study populations (Al Snih et al., 2009; Chen et al., 2010; Fried et al., 2001; Peek et al., 2012; Pollack et al., 2017; Rochat et al., 2010). As age was inversely associated with being pre-frail or frail, this finding may suggest that there is a selective survivor effect in this study's cohort. Thus, further research is warranted to examine the association of age and frailty in American Indians.

Like prior research (Ding, Kuha, & Murphy, 2017; Fried et al., 2001), we found that female gender and lower educational attainment were associated with an increased likelihood of being pre-frail or frail. It is not surprising that women would be more likely to be classified as pre-frail or frail, because studies have shown that older women are more likely to have a physical disability (Warner & Brown, 2011), and these conditions often overlap. Also, the association of ADL disability and frailty has been well established (Al Snih et al., 2009; Bandeen-Roche et al., 2006; Fried et al., 2001).

It is interesting to hypothesize as to why lower educational attainment has been consistently found to be associated with frailty. As an indicator of socioeconomic status, it is possible that persons with lower educational levels might lack the resources necessary to properly manage or treat their chronic conditions, leading to frailty. However, this explanation is less likely applicable to our sample as everyone was eligible without cost for health care, health promotion programming, and a recreation center provided by the tribe.

We found that an increase in the number of chronic conditions was a significant correlate of frailty/frailty status, a finding supported by other studies that have also relied on similar measurements of frailty (Chen et al., 2010; Rochat et al., 2010). It has been suggested to think of comorbidity as the accumulation of clinically manifested diseases, while frailty is the accumulation of subclinical losses of reserves across multiple systems (Fried et al., 2004). An important future focus would be to examine frailty as it relates to specific chronic medical conditions, which will facilitate identifying areas for intervention. To our knowledge, this is the first study to examine chronic pain severity as a correlate of frailty among older adults. Although greater chronic pain severity was significantly associated with frailty status in the bivariate analyses, it did not remain so when adjusted for the other covariates.

Some strengths and limitations of our study deserve acknowledgment. A notable strength was that most of the components of our frailty measure were based on objective measures of physical health. We also included measures, such as chronic pain severity, which have not been examined in previous studies. Limitations of our study include a sample from a single tribe. With great variability among American Indians tribal communities, the generalizability of these findings is limited to noninstitutionalized older adults of this tribe. The original study was not intentionally designed to examine frailty, leaving us to rely on a proxy weight loss measure. Also, our measurement of exhaustion used two items from the Centers for Epidemiological Studies–Depression Scale, precluding us from examining depression as a correlate. Last, our data were cross-sectional, which did not permit us to identify frailty determinants versus consequences among the examined correlates.

Our conceptual and research understandings of frailty and related constructs are ever expanding. For instance, although most research has relied on just the physical nature of frailty, other researchers have made a call for a broader model of frailty. This model includes the physical aspects of frailty as well as psychological and social components with a life course lens (Gobbens et al., 2010). Other researchers have drawn attention to a related construct to frailty referred to as physical resilience, defined as the ability to resist or recover from functional decline triggered by a health stressor (Whitson et al., 2016). It has been suggested that frailty and resilience are related in that frailty occurs in response to a decline in stress response systems while physical resilience occurs when one's stress response systems stay strong (Varadhan, Walston, & Bandeen-Roche, 2018). Subsequent research should consider these perspectives to improve our understandings that will inform clinical and public health approaches designed to prevent or delay frailty.

In summary, 2.9% of our community-based sample of American Indians aged ≥55 years was frail. Significant correlates of pre-frailty/frailty included younger age, female gender, lower educational attainment, increased number of chronic medical conditions, and increased number of ADL limitations. Our findings indicate that chronic medical conditions may be the most likely area in which to intervene when treating this population, with the goal of minimizing risk factors and preventing the onset of frailty. However, subsequent research would need to determine whether this prevalence is specific to this particular tribe or whether it also exists in other samples of older American Indians. With respect to the identified correlates of frailty status, longitudinal studies will help shed light on the specific causal relationships of these correlates with frailty. Such knowledge will be critical to guiding frailty prevention efforts.

Declaration of Conflicting Interests

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