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Prevalence and factors associated with frailty among Peruvian older adults

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ABSTRACT

The objective of this study is to examine the prevalence and factors associated with frailty in Peruvian Navy Veteran's older adults and family members. A total of 311 non-institutionalized men and women aged 60 years and older, from the Geriatrics Service of the Peruvian Navy Medical Center (Centro Médico Naval "Cirujano Mayor Santiago Távara") were assessed between May and October 2010. Frailty was defined as having two or more of the following components: (1) unintentional weight-loss, (2) weakness (lowest 20% in grip-strength), (3) self-reported exhaustion, and (4) slow walking speed (lowest 20% 8-m walk-time in seconds). Additionally, information on socio-demographic factors, medical conditions, depressive symptoms, disability, and cognitive function were obtained. Of the 311 participants, 78 (25.1%) were not frail, 147 (47.3%) were pre-frail, and 86 (27.8%) were frail. Using logistic regression analysis, we found that older age, being married, falls in the last year and disability were factors significantly associated with being frail. We conclude that prevalence of pre-frail and frail status in Peruvian Navy Veterans and family members is high. Our data reports risk factors for frailty that have been reported in the past in other population groups. A larger sample and longitudinal follow-up are needed to design and implement comprehensive geriatric interventions that can benefit Peruvian Navy Veteran's older adults at risk of becoming frail.

1. Introduction

Aging in Latin American countries is changing. The population aged 60 years and older is projected to increase at an annual rate of 3.5% during the first quarter of this century and represents three times the rate of increase of the total population (McNicoll, 2002). The percent of persons 60 years is currently 8% and is projected to increase to 14% in the year 2025 and to 23% in 2050 in these countries (McNicoll, 2002). Latin American adults are reaching old age with more chronic diseases, more disability, and fewer resources than older people in developed countries. It is estimated that about one million older adults will be added to the region's population each year during the next ten years (Kinsella & Wan, 2009; PAHO, 2002). Thus, by 2025, one in ten older adults will be aged 80 or older in Latin American countries (Kinsella & Wan, 2009; PAHO, 2002).

In Perú, 8.8% of the total population was 60 years or older in 2004 and chronic diseases were among the most important causes of death (PAHO, 2002). Projections for the year 2025 suggest that the older adult population in Perú will represent 12.4% of the total population, a similar demographic transition to the one observed in other Latin American countries (Kinsella & Wan, 2009; Varela, 2004). This growth will come with increases in prevalence of medical conditions and disability that will increase their risk of becoming frail. Frailty has been shown to decrease quality of life and further impair functional ability (Bortz, 2002; Fried et al., 2001).

Defined as "a physiologic state of increased vulnerability to stressors that results from decreased physiologic reserves, and even dysregulation, of multiple physiologic systems," (Hamerman, 1999) frailty is considered a highly prevalent syndrome and an

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important health problem associated with mortality, institutionalization and other adverse outcomes like falls, cognitive impairment and disability (Al Snih et al., 2009; Boyle, Buchman, Wilson, Leurgans, & Bennett, 2010; Ensrud et al., 2007; Fried et al., 2001; Fried, Ferrucci, Darer, Williamson, & Anderson, 2004; Rothman, Leo-Summers, & Gill, 2008; Samper-Ternent, Al Snih, Raji, Markides, & Ottenbacher, 2008). This condition is believed to be increasing rapidly among older adults in Latin American countries (Alvarado, Zunzunegui, Beland, & Bamvita, 2008; Avila-Funes et al., 2009). The number of studies that have examined the prevalence of frailty in older Latin American populations is limited. Few studies have analyzed this problem following commonly accepted methodologies making the data difficult to compare with data from other countries (Lawrence & Jette, 1996). One study of aging in Latin America and the Caribbean reports a prevalence of frailty between 30 to 48% in women, and between 21 to 35% in men (Alvarado et al., 2008). Conversely, findings from recent systematic review reported a prevalence of frailty between 4.5 to 59.1% (Borges & Menezes, 2011; Collard, Bother, Shoevers, & Oude Voshaar, 2012). Disability, falls, cognitive impairment, cardiovascular diseases, mood disorders, and inflammation were identifying as factors associated with frailty (Borges & Menezes, 2011).

Additionally, findings from the Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE) reported a prevalence of pre-frail and frail older adults of 55% among the largest minority group in the United States, Mexican-Americans (Ottenbacher et al., 2005). Diabetes, arthritis, smoking status, body mass index, cognition, and negative affect were significant predictors increasing the risk of frailty over time (Ottenbacher et al., 2009). Studies on frailty in Perú, like the rest of the region, are limited. Varela et al. in a sample of older adults reported a prevalence of frailty of 7.7% and found that disability and cognitive impairment were associated to frailty (Varela, Ortiz-Saavedra, & Chavez-Jimeno, 2008).

The objective of this study was to examine the prevalence and factors associated with frailty among Peruvian Navy Veteran's older adults and family members using a modified version of a validated frailty index (Fried et al., 2001) from the Geriatrics Service of the Peruvian Navy Medical Center (Centro Médico Naval "Cirujano Mayor Santiago Távara") that provides care for military personnel and their families.

2. Methods

2.1. Sample

Participants are from a hospital-based study cohort, assessed between May and October 2010. Sample size was calculated using a common prevalence formula (Bowers, 2008). For this study, patients from the Geriatrics Service of Centro Médico Naval "Cirujano Mayor Santiago Távara" (Peruvian Navy Medical Center) that had been seen as outpatients in the previous month were considered for our study. All participants were aged 60 years and older and resided either in Lima or Callao, Perú. Most of them were men and retired military personnel. The remaining participants consisted of their wives or parents. We created a database with all eligible participants. Participants were contacted over the phone and invited to participate in our study. According to our power calculation (80%) we needed 311 participants to be able to observe at least a 10% prevalence of frailty according to previous reports in the literature ranging from 4.9 to 59.1% (on average 10%) (Alvarado et al., 2008; Borges & Menezes, 2011; Collard et al., 2012; Fried et al., 2001; Ottenbacher et al., 2005; Varela et al., 2008). To reach this sample size we contacted 592 patients. Of these 592 patients, 281 were excluded: 217 refused to participate, 32 were unable to be present for the evaluation, 26 could not be reached with the available information, 5 were homebound and had home healthcare support, and 1 patient was hospitalized and unable to complete the interview. Thus, the final sample consisted of 311 participants which represent a response rate of 52.5% of the patients contacted to participate in the study. Information on sociodemographic characteristics, health conditions, psychosocial characteristics, anthropometric measures, physical function, and muscle strength measures were obtained in the clinical setting.

2.2. Measures

Frailty was assessed using a modified version of the phenotype described by Fried et al. (2001). This phenotype was originally composed of five criteria: weight loss, exhaustion, physical activity, walk time, and grip strength. For our cohort, we did not have a physical activity measure. Following the procedure used by other researchers we created a score using only 4 criteria (Ottenbacher et al., 2005). Additionally, body mass index (BMI) and height values used to adjust for hand grip strength and walking time were calculated based on our sample characteristics. Finally, shrinking and exhaustion were assessed using different questions than those used in the original phenotype; however, other authors have used them to evaluate frailty. Therefore, the frailty index used in our study is constructed using the following criteria:

(1) **Shrinking:** Weight loss was assessed with a self-reported question: "Have you recently lost weight such that your clothing has become looser? (Yes = 1, No = 0) derived from the Edmonton Frail Scale (Rolfson, Majumdar, Tsuyuki, Tahir, & Rockwood, 2006).
(2) **Weakness:** Grip strength was assessed using a hand-held dynamometer (MODEL Dynamometer, series 120286) and was measured in kilograms (kg). The test was administered by a trained interviewer and two trials were performed. The best of the two trials was used for scoring purposes. Participants who were unable to perform the grip strength test and those in the

Table 1
Percent of individuals for each frailty index component ($N = 311$).

Characteristic	Definition	*N* (%)
Shrinking	Self-reported weight loss: One question of EFS[a]: "*Have you recently lost weight such that your clothing has become looser?*"	103 (33.1)
Weakness	Lowest 20% in grip strength [adjusted by gender and BMI (kg/m^2)] for each quartile *Men* Strength ≤23.0 for BMI ≤22.0 Strength ≤23.0 for BMI 22.0–24.0 Strength ≤25.0 for BMI 24.0–28.0 Strength ≤25.5 for BMI > 29.5 *Women* Strength ≤24.0 kg for BMI ≤ 21.0 Strength ≤17.0 kg for BMI 21.0–24.0 Strength ≤23.0 kg for BMI 24.0–28.0 Strength ≤24.0 kg for BMI > 28.0	52 (16.7)
Exhaustion	One question of the GDS[b]: "*Do you feel full of energy?*"	133 (42.8)
Slowness	Slowest 20% of walking time from 4 m walk test adjusted by gender and median height (cm) *Men* Time ≥4.9 s for height ≤159 cm Time ≥6.5 s for height >159 cm *Women* Time ≥6.5 s for height ≤153.7 cm Time ≥7.0 s for height >153.7 cm	65 (20.9)

[a] EFS: Edmonton Frailty Scale.
[b] GDS: Geriatric Depression Scale.

lowest 20% adjusted for BMI and stratified by gender (Table 1) were categorized as positive for the weakness criterion (score = 1) (Fried et al., 2001).

(3) **Exhaustion:** Assessed with one question from the Geriatric Depression Scale: "Do you feel full of energy?" (Yes = 1, No = 0) (Ensrud et al., 2009; Sheikh & Yesavage, 1986).

(4) **Slowness:** Assessed over a 4-m timed walk test. Participants were asked to walk "as fast as felt safe". Height and gender adjusted time points were used (gender-specific cut-off at median height) (Table 1), with the slowest 20% and those unable to perform the test categorized as positive for the slowness criterion (score = 1) (Fried et al., 2001).

Participants with positive score in two or more components were considered frail. Subjects with positive score in only one component were considered pre-frail and those with no positive scores were considered not frail (Ottenbacher et al., 2005).

Sociodemographic variables: Age, sex, marital status and education were included as covariables. Age was used as a continuous variable. Marital status was dichotomized as currently married vs. unmarried (widower, single, divorced). In the Peruvian education system, to receive elementary and high school education takes 11 years. Having 12 or more years corresponds to graduate education. Thus, years of formal education was categorized in two groups: <12 years and ≥ 12 years.

Comorbidities: Participants were asked if they had the following medical conditions (Yes vs. No): cardiovascular (hypertension, chronic heart failure, peripheral vascular disease, syncope or myocardial infarction); pulmonary (chronic obstructive pulmonary disease, diffuse interstitial lung disease, asthma or lung cancer); neurologic (stroke, Parkinson's disease, herniated nucleus pulposus or amyotrophic lateral sclerosis); endocrinologic, (diabetes mellitus, thyroid disease); and psychiatric (esquizophrenia, anxiety disorders, personality disorders or substance dependence). They were also asked if they had any geriatric syndrome (immobility, pressure ulcers, delirium, constipation, terminal illness, sleep disorders, presbycusis/presbyopia, malnutrition, elder abuse). We created a count variable by summing all categories ranging from 0 to 6.

Hospitalization: Assessed by asking participants about the number of times they had been hospitalized in the last year (0 vs. 1 or more).

Functional status: The Barthel Index was used to measure functional status (Mahoney & Barthel, 1965a). The Barthel Index is a 10-item instrument that includes the following activities: feeding, bathing, grooming, dressing, bowel and bladder continence, toilet use, transferring bed to chair, mobility on level surfaces and use of stairs. Information about these activities was obtained by self-report or caregiver's report. The index score ranges from 0 to 100. A score of 60 or less indicates disability in activities of daily living (Mahoney FI & Barthel DW, 1965b).

Cognitive function: Assessed using the Clock Drawing Test (CDT), a quick screening test for cognitive dysfunction secondary to dementia, delirium, or a range of neurological and psychiatric illnesses (Borson et al., 1999; Royall et al., 2008; Nishiwaki et al., 2004). We asked participants to "imagine that this pre-drawn circle is a clock. I would like you to place the numbers in the correct positions then place the hands to indicate the time ten after eleven" (Royall et al., 2003). Then the results were categorized in 3 groups: no errors, minor errors, and major errors, using the procedure published by Rolfson et al. (2006). Participants with minor or major errors were considered to have cognitive impairment.

Polypharmacy: Assessed by asking participants the following: "Do you use five or more different prescription medications on a regular basis?" (Yes vs. No).

Depression: Assessed using one question from the Geriatric Depression Scale "Do you often feel sad or depressed?" (Sheikh & Yesavage, 1986).

Body mass index (BMI): Calculated using weight in kilograms divided by height in meters squared. Height was measured using a tape placed against the wall and weight using a scale (VEGA, model PT-CLX, series 2085).

2.3. Statistical analysis

Chi square and ANOVA tests were used to examine the distribution of covariates for subjects by frailty status. Logistic regression analysis was used to estimate the factors associated with frailty (2 or more components). Three Models were created. Model 1 included age, gender, marital status, and education. Model 2 included comorbidities, falls, depression, cognitive impairment, polypharmacy and BMI along with the variables in Model 1. In Model 3, disability was added to Model 2. All analyses were performed using the SAS System for Windows, Version 9.2 (SAS Institute, Cary, N.C.).

3. Results

The mean age was 76.1 years [Standard Deviation (SD) = 8.3], 59.5% of the sample were males ($n = 185$) and 51.8% of the sample ($n = 183$) were retired personnel from the Peruvian Navy Military

Table 2
Characteristics of the sample by frailty status ($N = 311$).

Variables	Non-frail *N* (%)	Pre-frail *N* (%)	Frail *N* (%)	*p*-Value
Total	78 (25.1%)	147 (47.3%)	86 (27.8%)	
Age, mean ± SD	75.05 ± 7.8	74.51 ± 8.4	79.67 ± 7.7	<0.0001
Gender (female)	31 (39.7)	57 (38.8)	38 (44.2)	0.71
Marital status (married)	44 (56.4)	115 (78.2)	72 (83.7)	<0.0001
Education (>11 years)	68 (87.2)	130 (88.4)	77 (89.5)	0.89
Falls in last year	45 (57.7)	87 (59.2)	67 (77.9)	0.0066
Hospitalizations in last year	47 (60.3)	75 (51.0)	49 (56.9)	0.37
Clock Drawing Test (≥1 error)	23 (29.5)	42 (28.6)	36 (41.9)	0.09
Polypharmacy (≥5 drugs/day)	11 (14.1)	27 (18.4)	21 (24.4)	0.23
BMI[a], mean ± SD	25.92 ± 6.1	25.28 ± 5.2	25.43 ± 5.9	0.72
Independence ADL[b], mean ± SD	96.35 ± 6.2	94.12 ± 12.2	91.51 ± 18.9	0.07
Comorbidities, mean ± SD	2.22 ± 0.9	1.97 ± 1.2	1.88 ± 1.1	0.13
Hand grip muscle strength, mean ± SD				
Males	39.7 ± 7.8	38.6 ± 8.2	27.7 ± 8.7	<0.0001
Females	41.6 ± 6.8	38.4 ± 9.4	26.1 ± 9.8	<0.0001
Walking time, mean ± SD	4.3 ± 0.4	4.7 ± 1.8	8.3 ± 6.1	<0.0001

[a] BMI: body mass index.
[b] ADL: activities of daily living, assessed with Barthel Index.

Table 3
Logistic regression analysis predicting frailty ($N = 311$).

Variables	Model 1 OR (95% CI)	p-Value	Model 2 OR (95% CI)	p-Value	Model 3 OR (95% CI)	p-Value
Age	1.08 (1.05–1.12)	< 0.0001	1.06 (1.03–1.10)	0.0006	1.06 (1.03–1.11)	0.0004
Gender (female)	1.35 (0.78–2.35)	0.29	1.33 (0.75–2.35)	0.30	1.40 (0.79–2.48)	0.24
Marital status (married)	2.17 (1.12–4.22)	0.02	2.47 (1.23–4.98)	0.01	2.50 (1.23–5.08)	0.01
Education (≥11 years)	1.35 (0.57–3.21)	0.49	1.53 (0.62–3.80)	0.30	1.91 (0.73–4.99)	0.17
Fewer comorbidities			0.89 (0.50–1.59)	0.61	0.93 (0.52–1.67)	0.74
Falls in the last year			2.02 (1.09–3.76)	0.02	2.09 (1.12–3.93)	0.02
Hospitalizations in the last year			1.13 (0.66–1.95)	0.72	1.11 (0.64–1.92)	0.75
Depression			2.53 (0.86–7.46)	0.12	2.15 (0.70–6.55)	0.20
Clock Drawing Test (≥1 error)			1.60 (0.91–2.82)	0.11	1.49 (0.84–2.65)	0.18
Polypharmacy (≥5 drugs/day)			1.43 (0.73–2.80)	0.31	1.24 (0.55–2.78)	0.50
BMI (kg/m^2)			1.00 (0.96–1.05)	0.87	1.01 (0.96–1.05)	0.83
Independence ADL[a]					0.98 (0.96–0.99)	0.04

[a] ADL: activities of daily living, assessed with Barthel Index.

Service. A total of 74.3% ($n = 231$) of participants were married, 88.4% ($n = 275$) had 12 or more years of education, 64% ($n = 199$) reported a fall in the last year and 55% ($n = 171$) were hospitalized in the last year. The most prevalent comorbidities were: cardiovascular diseases (66.8% ($n = 208$)), geriatric syndromes (50.5% ($n = 157$)) and pulmonary disease (23.2% ($n = 72$)). Six percent of participants reported depression ($n = 17$), 32.5% ($N = 101$) had cognitive impairment, and 19% ($n = 59$) were taking 5 or more prescribed medications. The mean BMI was 25.48 (SD = 5.65) and the mean Bartle Index score was 93.9 (SD = 13.5).

Table 1 presents the percentage of participants with abnormal scores in each frailty index component. Exhaustion (42.8%), unintentional weight loss (33.1%) and slowness (20.9%) were the components most frequently affected. Table 2 shows the descriptive characteristics of the sample by frailty status. Of the 311 participants, 78 (25.1%) were not frail, 147 (47.3%) were pre-frail, and 86 (27.8%) were frail. Compared to non-frail and pre-frail participants, frail participants were significantly more likely to be older, had one or more falls in the previous year, and scored low in hand grip strength and walk time test ($p < 0.0001$).

Table 3 presents the results of logistic regression analyses predicting frail status. Three Models were constructed. Model 1 included age, gender, education, and marital status. Model 2 included comorbidities, falls, depression, cognitive impairment, polypharmacy and BMI along with the variables in Model 1. Model 3 included disability along with all variables in Model 2. The significant factors associated with being frail in Model 1 were older age (p-value < 0.0001) and being married (p-value = 0.02). In Model 2, older age (p-value = 0.0006), being married (p-value = 0.01), and falls in the last year (p-value = 0.02) were the only factors significantly associated with being frail. In Model 3 (full Model) older age (p-value = 0.0004), being married (p-value = 0.01) and falls in the last year (p-value = 0.02) remained significantly associated with being frail, while participants with high score in the Bartle Index (0.04) were significantly less likely to be frail.

4. Discussion

The present study examined the prevalence and factors associated with frailty among older navy personnel and their family members aged 60 years and older living in Perú. We found that 27.8% of the participants were frail. Older age, being married and falls in the last year were found to be significantly associated with being frail, and those with better function were less likely to be frail.

The prevalence of frailty found in this study is comparable to previously published rates in other population groups. For example, in a community based-study of older Mexican Americans aged 70 years and older, the prevalence of frailty was 20% (Ottenbacher et al., 2005). The prevalence of frailty using data from seven cities in Latin America and the Caribbean ranged from 26.7% in Barbados to 42.6% in Chile. Additionally, the prevalence rates were higher in women (30% in Barbados to 48.2% in Chile) than in men (21.5% in Barbados to 35.4% in Brazil) (Alvarado et al., 2008). Findings using data from European countries show a lot of variability with reported prevalence between 8 to 50%.(Andela, Dijkstra, Slaets, & Sanderman, 2010; Syddall et al., 2010) This variability is partially explained by different measuring methods and different healthcare systems (Syddall et al., 2010). Other studies that use Fried's frailty phenotype reported a prevalence of 27.3% in Spain, 23% in Italy, 14% in Greece and an average prevalence of 17% including 10 participating countries (Santos-Eggimann, Cuenoud, Spagnoli, & Junod, 2009).

Our prevalence rate (27.8%) is noticeably higher compared to previously published data in Peru (7.7%), where the participants were younger, with less comorbidities and cognitive impairment than our sample (Varela et al., 2008). However, our findings on the factors associated with frailty are similar to previously published studies. For example, similar to what several investigators have reported (Alvarado et al., 2008; Andela et al., 2010; Ensrud et al., 2007; Fried et al., 2001; Ottenbacher et al., 2005; Syddall et al., 2010; Varela et al., 2008), older age and falls were associated with frailty risk in our study. To the best of our knowledge there are no studies that analyze differences in frailty between military and non-military personnel.

The current study has some limitations. First, because this was a cross-sectional study it was not possible to determine the temporal sequence between demographic characteristics, comorbidities, disability, cognitive function, depression and frailty status. Second, we did not measure physical activity, consequently our frailty index used four criteria, rather than the five used by Fried et al. (2001). Never the less, other authors have used four of the five components and have shown a good predictive ability of such an index (Ottenbacher et al., 2005). This could potentially underestimate frailty prevalence in our sample. Third, the findings are not generalizable to the older adult population in Perú since this was a selected sample of older adults Peruvian Navy Veterans and family members. Fourth, 32.5% of our sample had cognitive impairment which could underestimate the prevalence of frailty. Despite these limitations, this is the first study to examine the prevalence of frailty in a cohort of retired military older adults and their families living in Perú.

5. Conclusions

The prevalence of frailty in Peruvian Navy Veterans and family members is high and it is associated with age, marital status, falls, and disability. The findings of this study are very useful to understand the factors associated with frailty in this unique

population and provide useful information that will help us design comprehensive geriatric interventions to benefit our patients.

Conflict of interest

The authors disclose no conflict of interest.

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References

Al Snih, S., Graham, J. E., Ray, L. A., Samper-Ternent, R., Markides, K. S., & Ottenbacher, K. J. (2009). Frailty and incidence of activities of daily living disability among older Mexican Americans. *Journal of Rehabilitation Medicine, 41*, 892–897.

Alvarado, B. E., Zunzunegui, M. V., Beland, F., & Bamvita, J. M. (2008). Life course social and health conditions linked to frailty in Latin American older men and women. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 63*, 1399–1406.

Andela, R. M., Dijkstra, A., Slaets, J. P., & Sanderman, R. (2010). Prevalence of frailty on clinical wards: Description and implications. *International Journal of Nursing Practice, 16*, 14–19.

Avila-Funes, J. A., Amieva, H., Barberger-Gateau, P., Le, G. M., Raoux, N., Ritchie, K., et al. (2009). Cognitive impairment improves the predictive validity of the phenotype of frailty for adverse health outcomes: The three-city study. *Journal of the American Geriatrics Society, 57*, 453–461.

Borges, L. L., & Menezes, R. L. (2011). Definitions and markers of frailty: A systematic review of the literature. *Reviews in Clinical Gerontology, 21*, 67–77.

Borson, S., Brush, M., Eric, G., Scanlan, S., Vitaliano, P., Chen, J., et al. (1999). The Clock Drawing Test: Utility for dementia detection in multiethnic elders. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 54*[a], M534–M540.

Bortz, W. M. (2002). A conceptual framework of frailty: A review. *Journals of Gerontology Series A: Biological Sciences and Medical Science, 57*, M283–M288.

Bowers, D. (2008). *Medical statistics from scratch* (2 ed.). Chichester, UK: John wiley & Sons Ltd.

Boyle, P. A., Buchman, A. S., Wilson, R. S., Leurgans, S. E., & Bennett, D. A. (2010). Physical frailty is associated with incident mild cognitive impairment in community-based older persons. *JAGS, 58*, 248–255.

Collard, R. M., Bother, H., Shoevers, R. A., & Oude Voshaar, R. C. (2012). Prevalence of frailty in community-dwelling older persons: A systematic review. *JAGS, 60*, 1487–1492.

Ensrud, K. E., Blackwell, T. L., Redline, S., Ancoli-Israel, S., Paudel, M. L., Cawthon, P. M., et al. (2009). Sleep disturbances and frailty status in older community-dwelling men. *Journal of the American Geriatrics Society, 57*, 2085–2093.

Ensrud, K. E., Ewing, S. K., Taylor, B. C., Fink, H. A., Stone, K. L., Cauley, J. A., et al. (2007). Frailty and risk of falls, fracture, and mortality in older women: The study of osteoporotic fractures. *Journals of Gerontology Series A: Biological Sciences and Medical Science, 62*, 744–751.

Fried, L. P., Ferrucci, L., Darer, J., Williamson, J. D., & Anderson, G. (2004). Untangling the concepts of disability, frailty, and comorbidity: implications for improved targeting and care. *Journals of Gerontology Series A: Biological Sciences and Medical Science, 59*, 255–263.

Fried, L. P., Tangen, C. M., Walston, J. D., Newman, A. B., Hirsch, C., Gottdiener, J., et al. (2001). Frailty in older adults: Evidence for a phenotype. *Journals of Gerontology Series A: Biological Sciences and Medical Science, 56*, M146–M156.

Hamerman, D. (1999). Toward an understanding of frailty. *Annals of Internal Medicine, 130*, 945–950.

Kinsella, K., & Wan, H. (2009). *An aging world: 2008—International population reports.* Washington, DC: US Census Bureau.

Lawrence, R. H., & Jette, A. M. (1996). Disentangling the disablement process. *Journals of Gerontology Series A: Biological Sciences and Medical Science, 51*, S173–S182.

Mahoney, F. I., & Barthel, D. W. (1965a). Functional evaluation: The Barthel Index. *Maryland State Medical Journal, 14*, 61–65.

Mahoney, F. I., & Barthel, D. W. (1965b). Functional evaluation: The Barthel Index. *Maryland State Medical Journal, 14*, 61–65.

McNicoll, G. (2002). *World population ageing 1950–2050*. New York: Population Division UN.

Nishiwaki, Y., Breeze, E., Smeeth, L., Bulpitt, C. J., Peters, R., & Fletcher, A. E. (2004). Validity of the clock-drawing test as a screening tool for cognitive impairment in the elderly. *American Journal of Epidemiology, 160*, 797–807.

Ottenbacher, K. J., Ostir, G. V., Peek, M. K., Al Snih, S., Raji, M. A., & Markides, K. S. (2005). Frailty in older Mexican Americans. *Journal of the American Geriatrics Society, 53*, 1524–1531.

Ottenbacher, K. J., Graham, J. E., Al Snih, S., Raji, M., Samper-Ternent, R., Ostir, G. V., et al. (2009). Mexican Americans and frailty: Findings from the Hispanic established populations epidemiologic studies of the elderly. *American Journal of Public Health, 99*, 673–679.

PAHO. (2002). *Health in the Americas* (Vol. 2). Washington: PAHO.

Rolfson, D. B., Majumdar, S. R., Tsuyuki, R. T., Tahir, A., & Rockwood, K. (2006). Validity and reliability of the Edmonton Frail Scale. *Age and Ageing, 35*, 526–529.

Rothman, M. D., Leo-Summers, L., & Gill, T. M. (2008). Prognostic significance of potential frailty criteria. *Journal of the American Geriatrics Society, 56*, 2211–3116.

Royall, D. R., Espino, D. V., Polk, M. J., Verdeja, R., Vale, S., Gonzales, H., et al. (2003). Validation of a Spanish translation of the CLOX for use in Hispanic samples: The Hispanic EPESE study. *International Journal of Geriatric Psychiatry, 18*, 135–141.

Royall, D. R., Palmer, R. F., Chiodo, L. K., Polk, M. J., Markides, K. S., & Hazuda, H. (2008). Clock-drawing potentially mediates the effect of depression on mortality: Replication in three cohorts. *International Journal of Geriatric Psychiatry, 23*, 821–829.

Samper-Ternent, R., Al Snih, S., Raji, M. A., Markides, K. S., & Ottenbacher, K. J. (2008). Relationship between frailty and cognitive decline in older Mexican Americans. *Journal of the American Geriatrics Society, 56*, 1845–1852.

Santos-Eggimann, B., Cuenoud, P., Spagnoli, J., & Junod, J. (2009). Prevalence of frailty in middle-aged and older community-dwelling Europeans living in 10 countries. *Journals of Gerontology Series A: Biological Sciences and Medical Science, 64*, 675–681.

Sheikh, J. I., & Yesavage, J. A. (1986). Geriatric Depression Scale (GDS): Recent evidence and development of a short version. *Clinical Gerontologist, 5*, 165–173.

Syddall, H., Roberts, H. C., Evandrou, M., Cooper, C., Bergman, H., & Aihie, S. A. (2010). Prevalence and correlates of frailty among community-dwelling older men and women: Findings from the Hertfordshire Cohort Study. *Age and Ageing, 39*, 197–203.

Varela, L. (2004). *Profile of older adults in Perú [Perfil del Adulto Mayor en Perú] Lima.*

Varela, L., Ortiz-Saavedra, J., & Chavez-Jimeno, H. (2008). Frailty syndrome in community elderly people of Lima Metropolitana. *Revista de la Sociedad Peruana de Medicina Interna, 21*, 11.