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Original Study

Cross-Cultural Adaptation and Validation of the FRAIL Scale to Assess Frailty in Mexican Adults

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A B S T R A C T

Objectives: The objectives of this study were to cross-culturally adapt and validate the FRAIL scale in Mexican community-dwelling adults.
Design: Cross-sectional analysis of a prospective cohort.
Setting: The FraDysMex study, a 2-round evaluation of community-dwelling adults from 2 municipalities in Mexico City.
Participants: Participants were 606 men and women living in the designated area in Mexico City.
Measurements: Interviewers obtained data regarding demographics, comorbidities, mental status, nutritional status, dependency in activities of daily living, quality of life, mobility, balance, and strength. The FRAIL scale translated to Spanish and the Fried criteria were applied to screen frailty.
Results: The Mexican Spanish version of the FRAIL scale showed internal consistency (4 of 5 items in the scale correlated to the scale's total score, rho = 0.41–0.74), external consistency (interrater correlation CCI = 0.82), known-group validity based on age (9.6% of frailty in persons ≥50 years × 3.2% in persons <50 years, $P = .001$), convergent validity with the Fried criteria (CCI = 0.63), and the scale was also correlated with other measures related to frailty (such as age, quality of life, self-rated health status, cognition, dependency, nutritional status, depression, and physical performance).
Conclusion: The FRAIL scale was successfully adapted to Mexican Spanish and validated in community-dwelling Mexican adults.

Frailty is a clinical syndrome characterized by increased vulnerability, in which minimal stress can cause functional impairment.[1] The syndrome is a frequent condition worldwide. According to a literature review of studies from many countries, approximately 1 in 10 independently living adults aged 65 and older is frail.[2] In Mexico, the frequency of frailty in community-dwelling elderly ranges from 10.4% to 37.2%.[3–7] Studies have demonstrated that frailty is a strong predictor of major outcomes in the aging population, as falls, hospitalization, institutionalization, death, and disability.[4,8–11] In Latin America, there is limited access to health services and poor socioeconomic conditions, making elderly more vulnerable to these undesired outcomes.

As frailty is a dynamic condition, frail people can become nonfrail through targeted interventions. However, without proper treatment, people also can become definitely frail and more vulnerable to disability. Considering these, the screening of frailty in the clinical setting is highly recommended. The recognition of frail and prefrail states could minimize the burden in the aging population through early interventions.[1,12] Many frailty screening tools have been developed in the past years. The Cardiovascular Health Study Frailty Screening Measure (Fried Criteria) evaluates the frailty phenotype through the presence or absence of involuntary weight loss, exhaustion, slow gait speed, poor handgrip strength, and sedentary behavior.[8] Although it is one of the most used frailty screening instruments, in some instances the measure of grip strength and

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walking speed may not be easy to obtain. The FRAIL scale is a simple standardized 5-point questionnaire that does not require physical examination techniques. It can be easily applied by the physician, health care professional, or even by patients themselves. It also can be performed by telephone or self-administered questionnaires.[9,13,14] Moreover, it has been shown to predict mortality and disability,[9,15] and the mortality risk increases nonlinearly with its score similar to other frailty scales.[16] All these characteristics make the FRAIL a good instrument to be used in research surveys and as a screening tool in clinical practice.

The FRAIL scale has not been adapted and fully validated to be used in Mexico yet. In a relevant step toward its validation, a prospective study with data from the Mexican Health and Aging Study suggested its predictive validity.[7] In this study, the FRAIL scale was not directly applied to the participants. Its 5 points were adapted from questions already asked in the national survey.

Frailty is a frequent and potentially hazardous condition that should be screened in clinical practice. The FRAIL scale is a reliable and practical screening tool that still lacks its complete validation in Mexico. In this regard, the purpose of this study was to cross-culturally adapt and validate (reliability and validity) the FRAIL scale in Mexican community-dwelling adults.

Methods

Study Population and Design

The present study is a cross-sectional analysis of data from The FraDySMex (Frailty Dynapenia and Sarcopenia in Mexican Adults) Study, a cohort of community-dwelling adults, mainly from 2 municipalities in the southeast of Mexico City. Persons were invited to take part in the cohort through home visits made by a psychologist or a social worker from October 2014 to December 2015, and through folders left in churches, elderly community centers, social security centers, and health centers in the designated area. People eligible to participate in the study were those (1) who were able to mobilize with or without assisting devices, and (2) who were able to answer the study questionnaire for themselves or with the help of a caregiver if the Mini-Mental State Examination (MMSE) score was 10 points or less.[17] Those who were institutionalized, with decreased alertness for any cause, and those who had any acute or chronic condition, that in the judgment of the medical staff, could affect the ability of answering the questionnaire proposed and complete the objective evaluation, were excluded. The Study was approved by the Angeles Mocel General Hospital Ethics Committee and registered by the Instituto Nacional de Geriatría under the number DI-PI-002/2014. Written informed consent was obtained from all participants before the study. This study was partially funded by “Programa presupuestario con erogación para la igualdad entre mujeres y hombres de la Secretaría de Salud” and by the Instituto Nacional de Geriatría, Mexico City.

The study had a 2-round design. The first round consisted of the assessment of individuals from October 2014 to December 2014. In the second round, from October 2015 to December 2015, new persons were added to the cohort and a proportion of individuals who had participated in the first round were reevaluated. In both rounds, the participants attended the Functional Evaluation Research Laboratory at Instituto Nacional de Geriatría in Mexico City to be submitted to a series of objective evaluations by the medical staff, composed of geriatricians, internists, general practitioners, nurses, physical therapists, nutritionists, and specialists in geriatric rehabilitation. For analytic purposes, those included in the study were divided into 2 groups based on age: 50 years and older (older group), and younger than 50 years (younger group).

Frailty Screening

The FRAIL scale consists of 5 domains: fatigue, resistance, ambulation, illnesses, and loss of weight.[9,13,14] One point is attributed to each domain and the scale scores from 0 to 5 points (0 = best to 5 = worst). Scores from 3 to 5 represent frail status, 1 to 2 represent prefrail status, and 0 represents persons without frailty.

The translation retranslation method was used to cross-culturally adapt the scale to Mexican Spanish.[18] The instrument was blindly translated into Spanish by 2 professionals, and the differences between both versions were adjusted by a multidisciplinary panel of experts consisting of a nurse, an internist, a rehabilitation medicine specialist, and 2 geriatricians. The Spanish version was then retranslated into English by 2 other translators. The original scale was compared with the retranslated version by the expert panel, without finding differences. The final Spanish version was applied to 12 individuals to make sure it was comprehensible. It can be seen in Appendix 1.

The Fried criteria evaluate the frail phenotype through 5 components: unintentional weight loss, exhaustion, slow gait speed, poor handgrip strength, and low physical activity level.[19] One point is attributed to each component and a score of 3 or more defines frailty.[8] The definitions of the Fried criteria used in our population can be seen in Appendix 1.

Validation of the FRAIL Scale

To validate the FRAIL scale, we used the following procedures: (1) the internal consistency was obtained by the correlation of each item in the FRAIL scale with the scale's total score; (2) the external consistency was evaluated by the interrater test (1-week interval between the 2 measurements); (3) the convergent validity was assessed through the correlation between the FRAIL scale and the Fried criteria; (4) the known-group validity was calculated by comparing the frequency of frailty between the older and younger groups (our hypothesis postulated that the FRAIL scale would detect a higher frequency of frailty in the older subjects); (5) the validity between other measurements related to frailty in the older group: depression was assessed by the 7-item Center for Epidemiologic Studies Depression Scale Short Form (CES D-7).[20] The presence of disability was determined using the Barthel Index to assess basic activities of daily living (ADLs),[21] and the Lawton Instrumental Activities of Daily Living Scale to assess instrumental activities (IADLs).[22] The Mini Nutritional Assessment (MNA) was applied to evaluate nutritional status,[23] the EuroQol-5D (EQ-5D) to evaluate quality of life,[24] and the Short Physical Performance Battery (SPPB) to evaluate lower extremity functioning.[25] The total score obtained in all the scales was considered. Self-rated health status was extracted from the visual analogue scale present in the EQ-5D. Body mass index (BMI) was measured through a dual-energy X-ray absorptiometry machine (Hologic, Discovery, WI). Finally, to evaluate balance, the Modified-Clinical Test of Sensory Integration (m-CTSIB) (Balance System SD Operational/Service Manual; Biodex Medical Systems Inc., Shirley, NY) was performed in each participant. It is a time test that imposes postural challenges to explore balance on a firm or foam surface, with and without vision. In the present study, we considered only the evaluation in the foam surface, with closed eyes. The Sway Index obtained in the test is the SD of the stability index. The higher the Sway Index, the more unsteady the participant was during the test.

Statistical Analysis

Data were analyzed using PASW Statistics version 18 (SPSS Inc., Chicago, IL). Two sample size calculations were performed according to the Pearson correlation formula. The first was calculated based on a

minimum expected interrater correlation of 0.5 between the 2 FRAIL scale measurements. The security (Z1_a/2) value was 1.96 and the power (Z1_b) value was 0.84, which resulted in 29 participants being enough to prove the test. Nevertheless, a total of 46 participants were included. The second sample size was calculated considering the lowest correlation (rho = −0.19) between frailty and handgrip strength previously reported,[26] resulting in 123 participants. However, we included 543 participants.

Descriptive statistics are reported as means ± SDs for continuous variables and as frequencies for categorical variables. The Spearman test was used to correlate measurements without normal distribution: (1) each item in the FRAIL scale with the total scale's score (internal consistency), (2) other measurements related to frailty and the FRAIL total score (validation against other measurements), and (3) other measurements related to frailty and each domain in the FRAIL scale. The difference between the frequencies of frail and prefrail status in the older and younger group (known-group validity) was compared with Pearson's χ^2 test. The intraclass correlation coefficient (ICC) was obtained to correlate the FRAIL scale and the Fried criteria (convergent validity), and to the interrater correlation (external consistency). $P < .05$ was considered statistically significant.

Results

A total of 606 individuals were included in The FraDySMex cohort, 543 aged 50 years and older (older group) and 63 aged younger than 50 years (younger group). A total of 356 individuals were evaluated in the first round and 250 were added in the second round for this cross-sectional analysis. In the second round, 224 persons who took part in the first round were reevaluated for prospective purposes. However, this analysis was not included in the present study. The mean age of participants in the older group was 71.3 ± 9.6 years, and in the younger group it was 36.9 ± 8.5 years. Women comprised 79.5% of the total cohort. The characteristics of the study population, as demographics, comorbidities, mental status, nutritional status, dependency in ADLs, quality of life, mobility, balance, and strength are shown in Table 1.

Table 1
Characteristics of Individuals in the Older and Younger Groups

	Older, ≥50 y, n = 543	Younger, <50 y, n = 63
Age, y	71.3 ± 9.6	36.9 ± 8.5
Sex, women	434 (79.9)	48 (76.2)
Marital status*		
Married	192 (35.5)	23 (36.5)
Single	92 (17.0)	31 (49.2)
Divorced	27 (5.0)	1 (1.6)
Widowed	191 (35.3)	1 (1.6)
Other	39 (7.2)	7 (11.1)
Education*		
No education	9 (1.7)	0
Elementary school	136 (25.1)	0
High school	260 (47.9)	13 (20.6)
Bachelor's degree	121 (22.3)	43 (68.3)
Postgraduation	16 (3.0)	7 (11.1)
BMI (kg/m^2)	28.1 ± 4.8	26.1 ± 4.3
MMSE	26.7 ± 3.3	28.4 ± 1.8
CES D-7	5.0 ± 5.0	3.7 ± 3.9
EQ-5D	1.3 ± 1.5	0.4 ± 0.7
Score = 0	248 (45.7)	46 (73)
Score = 1	109 (20.1)	12 (19)
Score = 2	74 (13.6)	3 (4.8)
Score ≥3	112 (20.6)	2 (3.2)
Self-rated health status*	79.9 ± 16.0	83.7 ± 12.0
MNA	25.3 ± 3.1	25.5 ± 2.5
ADL	98.0 ± 5.3	99.9 ± 0.6
IADL	4.74 ± 0.7	5.0 ± 0.0
SPPB	8.8 ± 2.3	10.4 ± 2.5
Gait speed, cm/s*	95.9 ± 26.8	128.3 ± 43.6
Grip strength, kg*	19.7 ± 7.3	26.5 ± 9.8
Balance, Sway Index in a foam surface with closed eyes*	4.0 ±1.1	3.0 ± 0.6

*Two missing data were found for marital status; 1 missing datum was found for education; 2 missing data were found for self-rated health status; 4 missing data were found for gait speed; 12 missing data were found for grip strength.

Table 2
Internal Consistency of the FRAIL Scale

FRAIL Item	Correlation	*P*
Fatigue	0.474	<.001
Resistance	0.741	<.001
Ambulation	0.735	<.001
Illnesses	0.071	.099
Loss of weight	0.418	<.001

The item-total score correlations were analyzed by the Spearman test.

Scale Adaptation

There was no need to make any substantial change in the final Spanish version of the FRAIL scale.

Internal and External Consistency

Table 2 shows the internal consistency of the FRAIL scale. Four of 5 items were correlated to the scale's total score (rho ranging from 0.41 to 0.74), with the exception of number of illnesses. The interrater correlation was ICC = 0.82 for external consistency.

Validity

Table 3 shows the known-group validity based on age. The frequency of frailty, according to the FRAIL scale, was 8.9% in the total sample, and it was 9.6% in the older group. The prevalence of frailty was higher in the older group according to the FRAIL scale and the Fried criteria. The ICC between both instruments (convergent validity) was 0.63.

There was a statistically significant correlation between the FRAIL scale's total score and other measures related to frailty in the older group: age, EQ-5D, self-rated health status, MMSE, ADL, IADL, MNA, CES D-7, gait speed, grip strength, SPPB, and balance. Spearman correlations ranged from −0.38 to 0.37, as seen in Table 4. When correlating these other measurements with each domain in the FRAIL instrument, we found the following: (1) fatigue was correlated with EQ-5D, self-rated health status, MMSE, ADL, CES-D7, MNA, gait speed, grip strength, SPPB, and balance; (2) resistance and ambulation were both correlated with EQ-5D, self-rated health status, ADL, IADL, CES-D7, MNA, gait speed, grip strength, SPPB, and balance; (3) illnesses were correlated only with IADLs; and (4) loss of weight was correlated only with the MNA. These correlations are also shown in Table 4.

Table 3
Known-Group Validity of the FRAIL Scale Based on Age

Variables	Older, n = 543	Younger, n = 63	*P*
FRAIL scale			
Nonfrail	240 (44.2)	43 (68.3)	.001
Prefrail	251 (46.2)	18 (28.6)	
Frail	52 (9.6)	2 (3.2)	
Fried criteria			
Nonfrail	251 (46.2)	46 (73)	
Prefrail	238 (43.8)	17 (27)	.000
Frail	54 (9.9)	0 (0)	

The frequency differences were analyzed by Pearson χ^2 test.

Table 4
Validation Between the FRAIL Scale (Each Domain and Total Score) and Other Related Measurements

	Fatigue		Resistance		Ambulation		Illnesses		Loss of Weight		Total Score	
	Correlation	*P*	Correlation	*P*	Correlation	*P*	Correlation	*P*	Correlation	*P*	Correlation	*P*
Age	0.054	.214	0.165	.000	0.218	.000	0.021	.619	0.007	.874	0.188	.000
EQ-5D	0.270	.000	0.287	.000	0.323	.000	0.066	.126	0.008	.854	0.372	.000
Self-rated health status	−0.243	.000	−0.193	.000	−0.224	.000	−0.059	.172	0.045	.296	−0.252	.000
MMSE	−0.090	.036	−0.075	.079	−0.082	.055	0.041	.343	−0.060	.166	−0.124	.004
ADL	−0.115	.007	−0.112	.009	−0.150	.000	−0.072	.092	0.023	.601	−0.164	.000
IADL	−0.073	.090	−0.228	.000	−0.241	.000	−0.087	.042	−0.022	.616	−0.244	.000
CES D-7	0.305	.000	0.155	.000	0.159	.000	0.035	.417	0.058	.176	0.279	.000
MNA	−0.274	.000	−0.196	.000	−0.222	.000	0.054	.211	−0.266	.000	−0.388	.000
Gait speed	−0.161	.000	−0.288	.000	−0.349	.000	0.027	.537	−0.074	.084	−0.368	.000
Grip strength	−0.175	.000	−0.153	.000	−0.199	.000	0.051	.242	−0.075	.085	−0.242	.000
SPPB	−0.184	.000	−0.232	.000	−0.295	.000	0.071	.099	−0.035	.418	−0.309	.000
Balance (Sway Index)	0.113	.008	0.114	.008	0.204	.000	−0.032	.451	0.023	.592	0.184	.000

The correlations were analyzed by the Spearman test.

Discussion

The present study is the first to cross-culturally adapt and validate the Spanish version of the FRAIL scale to be used as a screening tool in Mexican community-dwelling adults. The scale showed convincing internal and external consistency, known-group, and convergent validity. It was also correlated with other measurements that are associated with frailty. This is also one of the few studies that focused in the psychometric properties of the FRAIL scale. Most studies were designed to obtain the scale's predictive validation,[15,27,28] including one recent Mexican study, that used an already existing national survey to adapt the items of the FRAIL scale.[7]

The frequencies of frailty in the older group (9.6% for the FRAIL scale and 9.9% for the Fried criteria) found in the present study were lower than in previous studies in Mexican community-dwelling older adults, in which it ranged from 14.1% to 37.2%.[3–7] Although the cutoff age used to divide our sample in the older and younger groups was 50 years, and not 60 years as in the other studies, the mean age of the older group was 71.3 years, similar to these studies. A possible reason is that the previous Mexican studies used different instruments to assess frailty.[29] In the studies that used the Fried criteria, the prevalence of frailty was 15.7% and 37.2%.[3,4] In the only study that evaluated frailty in Mexican adults using an adapted FRAIL scale, the frequency found was 10.4%,[7] very similar to ours.

Four of 5 domains evaluated in the scale were significantly correlated with the scale's total score, denoting its internal consistency. The only exception was with illnesses, and this could be because comorbidities may not be as related to the development of frailty as the other physical dimensions of the FRAIL scale. Indeed, there are largely used frailty screening tools that do not take into account the presence of comorbidities, as the Fried criteria and the Gerontopole Frailty Screening Tool.[8,30] The external consistency was considered strong, with an interrater correlation of 0.82.

The Spanish version of the FRAIL scale also showed moderate convergent validity (ICC = 0.63), as it correlated as expected with the Fried criteria, one of the most used frailty screening instruments. All the dimensions of the FRAIL scale are subjective, whereas the Fried criteria contain 2 objective dimensions (gait speed and grip strength). This difference could justify the lack of a stronger correlation between them. This is the first study to correlate both scales.

The correlations between the FRAIL total score and other measures related to frailty in the older group were moderate (rho < 0.4). The scale correlated with age, quality of life (EQ-5D), self-rated health status, cognitive status (MMSE), dependency (ADL and IADL), nutritional status (MNA), depression (CES-D7), gait speed, grip strength, lower extremity functioning (SPPB), and balance. A previous study found the association of frailty measured by the FRAIL scale with IADLs, SPPB, gait speed, and grip strength in persons without dependency in ADLs.[1] In a Korean study, using frailty status by the FRAIL scale as a linear term, there was a trend of incremental impairments in ADLs, depression, nutritional status, and physical performance.[31] Woo et al[32] also found that persons who rated their health as bad had a significantly increased risk of frailty defined by the FRAIL scale.

When evaluating the correlations of each dimension of the FRAIL scale with other measures related to frailty in the older group, our results were similar to those found by other studies. In the study of Morley and colleagues,[1] IADLs, SPPB, gait speed, and grip strength were, in agreement with our study, not associated with illnesses and weight loss, although we did find a correlation of IADLs with illnesses. In the Korean study, the results also were very similar to the present study, regarding ADLs, IADLs, cognitive impairment, and depressive mood.[31] Some differences were found in (1) the fatigue dimension, as in our study it was correlated with ADLs and MMSE, and (2) in ambulation, as in our study it was correlated with depression, but not correlated with the MMSE.

There are some limitations in this study. The sample comprises 2 of 16 municipalities in Mexico City, and it is an urban sample. As so, the results may not represent the national Mexican population that includes a large proportion of rural and semirural individuals. In these less-protected Mexican communities, the frequencies of frailty may be higher than that found in our study. Another limitation is the lack of a predictive validity, as it is a cross-sectional analysis of a prospective cohort. A longitudinal study of the cohort is needed to further validate the FRAIL scale in Mexico.

In summary, the FRAIL scale was cross-culturally adapted and validated to be used as a screening tool for frailty in Mexican community-dwelling adults. The scale is a reliable screening instrument to be used in clinical practice and research by geriatricians, nurses, and other health professionals. In Mexico, where frailty is a condition of much concern, preventive and targeted measures could be implemented with the early detection of frail and prefrail status, possibly leading to a decrease in the burden of this condition.

Supplementary Data

Supplementary data related to this article can be found online at http://dx.doi.org/10.1016/j.jamda.2016.07.008.

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