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Risk factors for frailty syndrome in the Costa Rican population

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Abstract

Objective: *The objective of this study was to identify the health risk factors related with the onset of frailty in the Costa Rican population.* **Methods:** *A subgroup of 3000 people from the CRELES study was analyzed. A frailty phenotype was constructed based on the variables of the phenotypic model: weight loss, exhaustion, weakness, slowness, and low level of physical activity. Patients were classified into frail, pre-frail, and robust. A multinomial logistic model was used, which included data from the 3 years of study (2205, 2007, and 2009). An exploratory analysis was made, using sociodemographic and health variables. Taking as reference the robust category, the odds ratio was obtained for the frail and pre-frail categories, with 95% confidence.* **Results:** *Of the analyzed variables, age, osteoarthritis, and living alone proved to be risk factors with statistical significance.* **Conclusions:** *In the Costa Rican population, age, osteoarthritis, and living alone represent risk factors for suffering frailty in the future.*

Key words: *Frailty. Risk factors. Elderly. Incidence.*

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INTRODUCTION

Between 2000 and 2050, the number of inhabitants on earth aged 60 years or older will double. A considerable number of them will have an elevated risk of becoming frail[1]. Frailty is considered a clinical state in which there is an increase in an individual's vulnerability for developing increased dependency and/or mortality when exposed to a stressor[2,3].

Although the operational definition of frailty is controversial, two approaches to defining frailty are widely accepted[3]. The deficit model, which consists of adding an individual's number of impairments and conditions to create a frailty index, and the second model, the phenotype model, which describes frailty as a clinical syndrome resulting from a combination of variables, such as weight loss, fatigue, weakness, diminished gait speed, and poor physical activity that reflects an underlying physiologic state of multisystem dysregulation[2,4].

Multiple population studies have shown the relationship between frailty and diverse conditions[5-7], and a few trials have been performed with Latin American populations and Central American populations[5].

The main goal of this study is to analyze the correlation of multiple health and sociodemographic variables and the risk of suffering from frailty in the future within the Costa Rican population.

MATERIALS AND METHODS

CRELES study

A longitudinal study design was established using The Costa Rican Longevity and Healthy Aging Study

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(CRELES), which is a dataset of Costa Rican older adults born in or before 1946; it included a representative sample of ≥ 60-year-old adults from Costa Rica. A full description of sampling methods may be found elsewhere[8]. This study has three waves in which face-to-face interviews were conducted by trained and standardized staff at the homes of older adults including in-depth data collection on demographics, current activities, health-related issues, social support, health-care use, financial status, functionality, cognitive status, anthropometry, and blood sampling. The analysis of the present study was performed using a cohort of 2827 elderly people, 60 years and older, beginning in 2005, with follow-ups in 2007 and 2009.

Construction of the frailty variable

A frailty indicator was constructed based on the five variables from Fried's phenotype model[4], with certain modifications. The variables were built as follows:

- Weakness: To measure this variable, a grip strength test performed with a dynamometer in the CRELES study was used. The elderly individual was asked to extend his or her dominant arm to full length alongside his or her body, and when instructed by the interviewer, the person was to grip the handle with all their strength and immediately loosen the grip. Then, he or she would rest for 3 min, repeating the test for the second time. The result of the second grip strength test was used for this study. This variable was registered in the anthropometric questionnaire.

A regression model was calculated in which hand strength was the dependent variable and the independent variables were sex and body mass index. Then, the residual values were added to the adjusted average value to create a standardized grip strength variable. The 20th percentile was calculated, resulting in a cutoff value. The patient was considered to have an altered grip strength test if his or her result was below the 20th percentile or could not perform the test at all.

- Slowness: To determine this variable, information obtained from questions in the CRELES anthropometric chapter was considered. Gait speed measured the capacity and time necessary to perform the stand-up and walk test. This test consisted of asking the person to stand-up from a chair and walk at his or her usual rhythm for a distance of 3 m. This distance is divided by the elapsed time, resulting in the speed of the elderly individual. Afterward, the regression model was adjusted, where the dependent variable was the calculated speed and the independent variables were height and sex, obtained from the CRELES database. The predicted values were calculated, and an average value was obtained. The residual values were added to this average value, which results in a new speed variable from which the 20th percentile was calculated.

A decreased gait speed was considered if one of the following conditions was present: the patient had a gait speed lower than the 20th percentile value, or the person could not do the test at all, or if the person answered affirmatively to the question: "Do you have a problem that prevents you from doing any mobility or flexibility test?"

- Low level of physical activity: For this variable, the answer for the question "In the past 12 months, have you had regular exercise or rigorous physical activity such as sports, trotting, dancing, or heavy workloads 3 times a week?" Was used. The variable was taken as is from the CRELES study, and it was considered altered if there was no physical activity.
- Exhaustion or poor endurance: The answer to the question "Were you full of energy?" From the CRELES study was used for this variable. The variable was considered altered if the elderly responded that they felt they had no energy whatsoever.
- Weight loss: For this variable, the answer to the question, "In the past 6 months, have you lost > 5 kg of weight without planning it?" Was used. If the patient answered affirmatively, the variable was considered altered and was incorporated the frailty syndrome.

Once the five variables were defined, they were codified as 1 if they met the frailty criteria on a particular variable, and 0 if the criteria were not met. A classification of robust was given to those who did not present altered variables on any of the five variables analyzed (which translates to a total sum of 0 for all variables), a classification of pre-frail for those who presented one or two altered variables, and a classification of frail to those who presented three to five altered variables. It is worth mentioning that if any values were missing, the individual was not included, as there was a strict method to prevent biases for this categorization. This methodology was also used for the cohort follow-up years of 2005, 2007, and 2009.

With the goal of investigating possible risk factors for the frailty condition, an incidence analysis was

Table 1. Costa Rica: Results of the prevalence and incidence model for frailty according to sociodemographic indicators

Health and sociodemographic characteristics	Prevalence‡				Incidence§			
	Pre-frail		Frail		Pre-frail		Frail	
	OR	CI	OR	CI	OR	CI	OR	CI
Age								
80+	4.86	2.07; 9.06*	20.77	10.23; 42.15*	4.12	1.07;15.86*	18.69	1.89; 184.72*
70-79	1.69	1.31; 2.18*	2.25	1.51; 3.35*	1.46	0.89; 2.39	2.33	0.59; 9.22
Education level								
≤ 6th grade	2.09	1.53; 2.84*	1.77	1.00; 3.16	-	-	-	-
7-9th grade	1.83	1.19; 2.80*	1.64	0.74; 3.62	-	-	-	-
≥ 10th grade†	-	-	-	-	-	-	-	-
Sex								
Woman	1.15	0.88; 1.51	0.70	0.46; 1.08	1.34	0.78; 2.31	4.06	0.78; 21.17
Live alone								
Yes	1.17	0.78; 1.75	1.59	0.90; 2.79	1.43	0.55; 3.75	6.91	1.36; 35.20*
Health self-perception No healthy	2.34	1.82; 3.01*	5.60	3.78; 8.30*	2.00	1.11; 3.60	0.21	0.03; 1.37
Income								
≤ 100 US dollars	0.98	0.71; 1.34	1.23	0.75; 2.03	0.59	0.31; 1.12	1.62	0.31; 8.40
100-250 US dollars	1.01	0.75; 1.37	0.78	0.47; 1.28	1.01	0.55; 1.87	3.72	0.73; 18.87
≥ 250 US dollars†	-	-	-	-	-	-	-	-

*p < 0.05.
†category of reference.
‡model taking into account data of the year 2005.
§data of 2005, 2007, and 2009 are included.
CI: confidence interval at 95%; OR: odds ratio.

performed. For that analysis, data from the three follow-up years of the elderly cohort (2005, 2007, and 2009) were used. For this analysis, a multinomial logistic model was used, including data for those 3 years, as well as the elderly identifier. The frailty indicator for the study years was used as the dependent variable, divided into frail, pre-frail, and robust. As inclusion criteria for independent variables, the study focused on an exploratory analysis in which a widespread quantity of variables in the health and sociodemographic fields was considered based on expert judgment. Specifically, the included variables were obtained from the elderly questionnaire, Section C (health status) from CRELES, related to detected health conditions by the physician. Other socioeconomic factors were obtained from the same questionnaire from the section regarding personal identification data, as well as the employment and income sections. Variables that presented difficulties for model convergence were not included, nor were variables with missing information within their categories.

As a result, odds ratio for the frail and pre-frail categories was obtained, and the robust category was taken as reference, as it was considered the healthiest among the three categories. To compare relevance and possible error in the OR estimation with 95% confidence, intervals were created for each variable of interest.

RESULTS

For the year 2005 (base year for the study), after application of the inclusion criteria mentioned above, an initial base sample consisting of 2827 patients was used. Afterward, this sample was reduced for the years 2007 (n = 2364) and 2009 (n = 1863). During this period, a total of 964 cases were lost; a total of 525 due to death and 439 because it was impossible to contact the individual for follow-ups.

For the base year 2005, the final analysis shows a prevalence of frailty in the elderly population of 11%. The general characteristics of the frail patient in Costa Rica were analyzed in a previous publication[7].

Of the variables analyzed, only three proved to be statistically significant risk factors. These variables were age (OR 18.6, CI 1.89; 184.73), presence

Table 2. Costa Rica: Results of the prevalence and incidence model for frailty according to health and comorbidities indicators

Variable	Prevalence†				Incidence‡			
	Pre-frail		Frail		Pre-frail		Frail	
	OR	CI	OR	CI	OR	CI	OR	CI
Hypertension Yes	1.01	0.80; 1.27	1.52	1.04; 2.20*	1.31	0.85; 2.12	1.09	0.30 3.98
Cholesterol Yes	0.94	0.75; 1.20	0.64	0.44; 0.93*	0.78	0.48; 1.27	1.38	0.38; 5.06
Diabetes Yes	1.50	1.10; 2.03*	2.47	1.61; 3.79*	1.04	0.56; 1.94	3.74	0.63; 22.1
Cancer Yes	1.99	1.06; 3.76*	2.12	0.92; 4.88	-	-	-	-
Pulmonary disease Yes	1.62	1.16; 2.26*	1.82	1.14; 2.92*	0.49	0.21; 1.80	2.46	0.34; 17.9
Heart attack Yes	0.78	0.45; 1.37	0.55	0.24; 1.28	-	-	-	-
Cerebrovascular event Yes	2.87	0.77; 10.71	20.90	5.31; 82.33*	-	-	-	-
Arthritis Yes	1.48	1.01; 2.17*	3.19	1.95; 5.22*	0.77	0.29; 2.04	5.46	1.08; 27.7*
Osteoporosis Yes	1.43	0.91 ; 2.25	1.88	1.02; 3.46*	-	-	-	-
Smoking Yes	0.90	0.70; 1.16	0.83	0.55; 1.24	0.91	0.54; 1.53	1.88	0.39; 9.09
Falls Yes	0.86	0.69; 1.08	1.03	0.72; 1.47	0.87	0.511; 1.48	0.73	0.18; 3.03

*p < 0.05.
†model taking into account data of the year 2005.
‡data of 2005, 2007, and 2009 are included.
CI: confidence interval at 95%; OR: odds ratio

of osteoarthritis (OR 5.46 CI 1.076; 27.65), and living alone (OR 6.9 CI 1.36; 35.2).

Other variables, such as hypertension, diabetes mellitus, dyslipidemia, cancer, lung disease, osteoporosis, heart failure, strokes, smoking, falls, educational level, income, and health self-perception, did not show any significant association in this model (Tables 1 and 2).

DISCUSSION

In this study, age was shown to be a risk factor for the presence of frailty. Patients 80 years of age or older presented an increased risk for becoming frail. Furthermore, age 80 and above proved to be a risk factor for presenting a pre-frail condition when compared to the robust patients (OR 4.12 CI 1.07; 15.9).

This result was similar to multiple publications that have documented that age, per se, is a risk factor for the frail condition[7,9-11]. Various mechanisms can be mention as contributors, mainly the oxidative stress associated with aging and secondary cellular damage that triggers multiorgan and system failure, possibly resulting in vulnerability and decreased physiological reserves[12,13].

Although age as a risk factor for frailty is not a new concept in other parts of the world, this is the first study performed in a Central American location showing this correlation and is one of the few longitudinal studies in Latin America[5,14,15].

This study was also able to determine that osteoarthritis is a risk factor for the presence of frailty in the Costa Rican population. After adjusting for this variable, an increased risk for suffering frailty was documented. The risk was greater than what has been presented in other similar studies[14].

The association between frailty and arthritis has been documented in other cohorts and longitudinal studies previously performed[7,16]. Fried's study has already documented a link between self-reported

arthritis and frailty[4]. This finding has been reproduced in similar studies[17], including in a Latin American population cohort[7,18], as well as in longitudinal studies[9].

The association between osteoarthritis and frailty is due to the limitation in physical activity secondary to pain. There have been reports of an increase in the incidence of frailty syndrome and the presence of secondary pain resulting from diseases such as osteoarthritis[19,20]. Pain may lead to a decrease in physical activity, immobility, fatigue, and sarcopenia.

The "living alone" variable in this study was a risk factor for the onset of frailty syndrome. Fried suggested a frailty model that includes a "vicious cycle" that comprises frailty, chronic malnutrition, sarcopenia, poor chronic disease control, symptoms of depression, and sedentarism[4], all of which are more prevalent in the elderly who live alone.

To the author's knowledge, this is the first longitudinal study that demonstrated this correlation. Other cohort studies showed the relationship between living alone and frailty[4,17,21], including one trial that presented this condition as a protective factor[10]. This result warrants future investigations that include this variable as a risk factor for the presence of frailty syndrome and identifying mechanisms to protect the elderly from the consequences involved.

Given the longitudinal nature of the CRELES study, the analysis performed in the three study years involved many cases (n = 964) that were lost due to death and other unknown causes. This mainly affected the last year of the cohort. Loss of data significantly affected the construction of the frailty variable in the years under study, as five variables were used during the time span, of which some presented problems regarding missing information, therefore, affecting the final elaboration of the frailty variable.

In addition, the variables of interest with regard to the frailty syndrome present certain problems during the 3 years of the study, resulting in problems in the construction of the incidence model, as cases must be matched across all years to allow its estimation.

The main consequence in this study can be observed in the uncertainty reflected in the wide confidence intervals for the variables analyzed. This was caused by some large odds ratio and errors in estimation, which were also wide, resulting from a significant reduction of the sample size for some variables, along with their great variability. Therefore, when interpreting the final sample with less available cases, caution should be exercised regarding the results obtained.

Another limitation present in the study was the fact that many of the variables being analyzed were based on self-report of comorbidities. Many of the questions were written in non-technical language, so interviewees could understand what they were asked.

Despite the study limitations, the results generated do represent the Costa Rican population. Furthermore, the criteria used for this study were more similar to Fried's original criteria when compared to previous studies at a national and international level, which provided more robust results than in other similar studies.

The weight that certain comorbidities have in the onset of the frailty syndrome in the Costa Rican elderly population was demonstrated, being to the author's knowledge, one of the few Latin American studies and the only one in Central America that truly analyses these factors, allowing visualization of this important condition in this area of the American continent. This allows us to assess the needs for future investigations in this area and to take preventive actions involving specific elderly groups to avoid frailty syndrome and its consequences.

CONCLUSIONS

At present, there is little information regarding the risk factors that lead to the onset of the frailty syndrome in the Latin American population and, specifically, in the Central American population. In the Costa Rican population, age, the presence of osteoarthritis, and living alone are risk factors for suffering this syndrome in the future. Other variables did not show this association.

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THE JOURNAL OF LATIN AMERICAN GERIATRIC MEDICINE ORIGINAL ARTICLE

Prevalence of diabetes mellitus by self-report and hyperglycemia (subanalysis of the SABE survey)

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Abstract

Introduction and Objectives: *Diabetes mellitus (DM) has become one of the most prevalent diseases of the XXI[st] century. The objective of this study was to determine the prevalence of self-reported DM and hyperglycemia in patients of 60 years and over who participated in the Health, Well-being, and Aging survey (SABE) in the city of San Luis Potosi.* **Materials and Methods:** *This was a transverse study. A subanalysis of the data obtained in the SABE survey, as well as capillary blood glucose tests, was analyzed.* **Results:** *A total of 1854 patients were interviewed, with a mean age of 72 years. The prevalence found for self-reported DM was 22.44%, for undiagnosed diabetes 4.5%, and for hyperglycemia 14.3%.* **Conclusion:** *The prevalence of DM by self-report, as well as the hyperglycemia found in this study, suggests a higher prevalence of DM than in other places. Although the diagnosis of DM is the same in older adults than in young adults, the pathophysiology is different, and this results in a hyperglycemia that is not diagnosed. In low-resource areas or in older patients in whom transportation is difficult, glucose tests can be used as a screening test for DM in this age range.*

Key words: *Elderly. Diabetes mellitus. Prevalence. Sabe.*

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INTRODUCTION

Aging is a dynamic process that has a common denominator the loss of the body's reserve mechanisms. Because of this the body is less able to adapt to external changes. This is why older patients can develop a state of frailty that increases the risk of developing a disability and dependence if exposed to disease[1].

There is no definite consensus as to the age at which a patient becomes elderly. The American Diabetes Association (ADA) includes patients older than 65 years of age, whereas the World Health Organization (WHO) refers to elderly adults as any adult older than 60 years of age[2,3].

The WHO estimates that between 2015 and 2050 the population older than 60 years of age will triplicate and go from 600 million to 2000 million, with the highest increase in low- and middle-income countries. This represents a higher demand for health services by this sector of the population, due to non-communicable diseases (NCDs) [4].

In Mexico, in 2010, there were 10.1 million people older than 60 years of age which corresponds to 9% of the population. With an annual growth rate of 3.8% in the year 2013, there will be 20.4 million people in this age group. In the state of San Luis Potosi, there is a growth rate of 3.2% which situates the state as the 15[th] state with the most elders in the country[5,6].

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In Mexico, the aging process is not only reversible and as a result of the increase in this population there has also been an epidemiological transition characterized by the presence of infectious diseases but also by a rise in the prevalence of chronic NCDs[7]. Many of these diseases are starting at earlier stages of life and entering old age with a series of comorbidities, complications, and disabilities[8,9].

Diabetes mellitus (DM) has become one of the most prevalent diseases of the XXI[st] century and is a global health concern. According to the International Diabetes Federation (IDF), one in every 11 adults in the world lives with DM as well as one-third of elderly adults over 60 years of age. It is also important to highlight that one in every two adults is undiagnosed and 352 million people with hyperglycemia are at high risk of developing DM[10].

The 10 countries with the highest prevalence's of DM are China, India, the USA, Brazil, Mexico, Indonesia, Russia, Egypt, Germany, and Pakistan. At present, Mexico has 12 million people diagnosed with DM and the state of San Luis Potosi has one of the highest prevalences of the country[11].

In the halfway health and nutrition survey 2016 (ENSANUT MC2016), the highest prevalence of DM was among participants of 60-70 years of age[12].

DM is a chronic metabolic disease that is due to a lack of secretion or action of insulin. The main risk factors are advanced age, obesity, malnutrition, sedentary lifestyle, smoking, and genetic factors[13,14].

Insulin secretion and sensibility decrease with age. Many factors contribute to insulin resistance in old age such as central obesity, secretion of vasopressin or copeptin, Vitamin D deficiency, and hypomagnesemia. A 15 mg/dl increase in postprandial glycemia has been demonstrated after the third decade of life[15].

Diagnostic criteria for DM is the same at any age: glycosylated hemoglobin (HbA1c) ≥ a 6.5%, fasting plasma glucose 126 mg/dl, plasma glucose 2 h after an oral dose of glucose ≥ 200 mg/dl, or a random measurement ≥ 200 mg/dl accompanied by symptoms[16].

In elderly patients, it is important to take into account that hyperglycemia symptoms are different than in younger patients. These can be unspecific and of late-onset such as fatigue, lethargy, cognitive impairment, weight loss, urinary incontinence, falls, and urinary symptoms[17].

The objective of this study was to determine the prevalence of self-reported DM and hyperglycemia in subjects older than 60 years of age that participated in the Health, Well-being, and Aging survey (SABE) in San Luis Potosi.

MATERIALS AND METHODS

This was a transversal study with a subanalysis of the data obtained in the SABE survey in San Luis Potosi. The methodology of the SABE survey was used to calculate sample size per zone for inhabitants of ≥ 60 years according to the II population and housing census of 2005 from the National Institute of Geography and Statistics.

Confidence intervals at 95% were calculated and a standard error of ± 5% with a 50% success rate. The sample size was calculated according to proportions considering a binomial distribution of the questionnaire, where the probability of success is based on finding one or more adults ≥ 60 years in one household. The total sample size was 2305 surveys, accounting for loss a total of 2320 questionnaires were applied. Of these, 1850 consented to capillary glucose test.

The survey consisted of 11 sections with 486 items in total and one section of identification data. The survey was carried out in all of the state (58 municipalities), in urban and rural areas.

For this subanalysis, only the variables of interest were selected. Capillary glucose measurement was taken with a Accu-Chek Performance meter. The capillary glucose tests were taken after the survey was finished (approximately 2 h). All participants gave verbal consent and personal data were kept by the main researchers with confidentiality procedures.

The data for the prevalence of DM were collected by self-report. This implied that the person being interviewed had a previous medical diagnosis of DM and was aware of having this disease. People that answered "I don't know" were considered as not having DM as well as people that answered no.

Age was categorized according to the WHO criteria (60-75 years, 76-90 years, and 91-100 years). The capillary glucose measurements were grouped into glycemia ≤ 140 mg/dl, 140 mg/dl-199 mg/dl, and ≥ 200 mg/dl since the time since the last meal of the patient was unknown but considered at least 2 h, considering that in Latin America you can only count on the determination of capillary glucose and not with plasma glucose for population screening, recognizing that the definitive diagnosis must be made with the measurement of plasma glucose and that capillary glycemia can have an average variability of 0.58

Table 1. Glycemic ranges by age group according to the WHO

Glycemia ranges	60-75 years (CI 95%)	76-90 years (CI 95%)	91-100 years (CI 95%)
≤ 140 mg/dl	69.7% (67.13-72.23)	73.8% (70.19-77.43)	88.57% (77.87-99.27)
141-199 mg/dl	16.48% (14.42-18.54)	17.75% (14.60-20.89)	11.43% (0.73-22.21)
≥ 200 mg/dl	13.84% (11.92-15.75)	8.44% (6.15-10.72)	0%

Frequencies calculated over 1854 participants.
CI 95%: confidence interval 95%

Table 2. Population characteristics

Variables	With self-reported DM (CI 95%)	Without self-reported DM (CI 95%)
Male	33.2% (28.6-37.7)	46.5% (43.9-49)
Female	66.8% (62.3-71.4)	53.5% (51-56)
60-75 years	77.2% (73.11-81.21)	64.60% (62.13-67.08)
76-90 years	22.6% (18.56-26.63)	33% (30.6-35.46)
91-100 years	0.2% (–0.2-0.7)	2.4% (1.6-3.2)
Total	100%	100%
Glycemia ≤ 140 mg/dl	37.5% (32.83-42.17)	81.1% (79.06-83.11)
Glycemia 141-199 mg/dl	25% (20.82-29.178)	14.4% (12.58-16.21)
Glycemia ≥ 200 mg/dl	37.5% (32.83-42.17)	4.5% (3.44-5.60)
Total	100%	100%

Frequencies calculated over 1854 participants.
CI 95%: confidence interval 95%, DM: diabetes mellitus

mmol/l when it is compared with blood glucose measurements. However, studies have been published that have found a high correlation coefficient (0.97) between both methods[18].

For the statistical analysis, central tendency and dispersion measurements were calculated as well as frequencies for the according to variables. To calculate the association between age and glycemia in patients without self-reported DM, we calculated X2 with Fisher's exact test, given that there are categories with < 5 observations. All statistical analyses were carried out using STATA 12®.

RESULTS

Of the 1854 surveyed participants, 806 were male and 1048 female. The age distribution was as follows: 67.4% 60-75 year olds, 30.7% 76-90 years, and 1.9% > 90. The mean age was 72 years (SD 8) with a maximum age of 100. The mean capillary glucose was 139 mg/dl (SD 69) with a range of 54-572 mg/dl.

Capillary glucose levels by age category are shown in table 1.

A total of 22.44% of the surveyed people said that they had diagnosis of DM (33.2% of the men and 66.8% of women). Whereas of the people that said not to have DM, 4.5% had glycemia ≥ 200 mg/dl and 14.4% had glycemia between 141 and 199 mg/dl. The characteristics of the population by diagnosis of DM are shown in table 2.

When analyzing the association between age and capillary glucose levels in patients without DM diagnosis, there was no statistically significant result. Figure 1 shows how of the studied population without diagnosis of DM there are no people with glycemia ≥ 200 mg/dl in the age group of ≥ 90 years, and the number of patients with glycemia ≤ 140 mg/dl increases with age.

DISCUSSION

Diabetes in elderly patients is a risk factor for developing geriatric syndromes. This has become a challenge for government and health institutions given the rise in both life expectancy and aging. The prevalence of self-reported DM in elderly patients has been reported

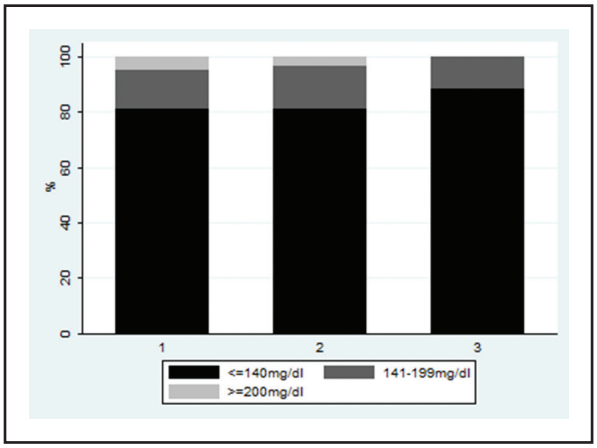

Figure 1. *Glucose measurements in patients without self-reported diabetes mellitus by age group. 1 = 60-75 years; 2 = 76-90 years; 3 = 91 and older; percentage of the population.*

to be 20.8%, similar to what we have found in this study of 22.44%[19].

In the SABE 2010 survey in the state of Mexico, there was a reported prevalence of DM of 26.1% in people older than 60 years of age, while in the ENSANUT MC 2016, there was a prevalence of 30.3% in people from 60 to 69 years of age. Our study coincides with other SABE results but differs from ENSANUT MC probably due to the larger number of surveyed population in ENSANUT MC[12,20].

A study of the disease in San Luis Potosi shows that the prevalence of DM will continue to rise and as such so will the geriatric syndromes. This binomial represents a heavy load to health systems due to the costs it generates. There is an estimated expenditure of 27 thousand million dollars due to the DM, 58 thousand million due to its complications, and 31 thousand million due to general costs[19].

DM is still subdiagnosed in elderly patients. The percentage of undiagnosed cases reaches 41.5% among individuals from 60 to 74 years of age[21]. Data from the ADA report a prevalence of 23.8% of undiagnosed diabetes[22]. In Mexico in patients older than 50 years of age, there is a prevalence of 18% of undiagnosed DM, in the age group of 60-69 years, there is a 33.5% prevalence, and in the > 70 years' group 23%. The factors that are most associated in Mexican population to undiagnosed DM are overweight and obesity[23]. Other studies carried out in Mexico report a prevalence of undiagnosed DM of 10.23% in people > 60 years[19].

The prevalence of hyperglycemia in our study was of 37.5% in patients with diagnosis of DM and 4.5% in patients without diagnosis. Glucose levels higher than 200 mg/dL in patients without a diagnosis of DM could represent undiagnosed DM. If we compare our results to those of undiagnosed DM in Mexico and worldwide, there is a lower prevalence of undiagnosed DM in our population. This can be due to the diagnostic method, capillary glucose versus glycosylated hemoglobin or to a smaller number of participants and the time at which the capillary tests was taken[19].

Hyperglycemia is one of the main risk factors for the appearance and progression of complications due to DM. A sustained elevation provokes changes in tissue and plasma proteins. This generates an accumulation of superoxide at mitochondrial level. This is a key step in the activation of metabolic pathways that are implicated in the pathogenesis of complications in patients with DM[24,25].

Due to a loss in the secretory phase of insulin, there is postprandial hyperglycemia in elderly patients. This is associated to higher cardiovascular morbidity and mortality as has been described by studies such as diabetes epidemiology: collaborative analysis of diagnostic criteria in Europe. This study shows that fasting glucose does not contribute to the prediction of mortality but postprandial glucose does[26].

The study CARMELA in Mexico demonstrated that the glucose concentration increases with age. In our study, we found the opposite, a decrease of glycemia with age. This could be explained because in our population the people that reach very old ages are those without DM[27].

At present, the association between geriatric syndromes and DM has not been taken in to account by the health systems in Mexico even though this population has a higher risk of hospitalization. There are no institutions for specialized care of chronic diseases even though there is a high prevalence[28,29].

Mexico occupies the eight places worldwide for expenditure due to DM with an approximate of 19 thousand million dollars. This is added to the cost of frailty syndrome that on average costs 191,102 pesos annually. If we understand that DM participates in geriatric syndromes using an integrated geriatric evaluation, there could be a decrease in the health expenditure generated in the country[30].

CONCLUSION

The increase in life expectancy is a reflection of a countries economic development. This increase in longevity is accompanied by physiological changes that predispose the individual to a higher burden of diseases with atypical presentations which make

them a diagnostic challenge and decrease a successful aging process.

The prevalence of DM by self-report in our study was higher than the national prevalence for elderly people. Furthermore, the prevalence's of hyperglycemia found in this study suggests that the prevalence of DM in older patients is higher than what has been reported elsewhere.

Even though the diagnosis of DM is the same in older adults than in younger people, the physiopathology is different, commonly affecting insulin secretory phase. This translates as a postprandial hyperglycemia which is why fasting glucose levels subdiagnose this disease. In low-resource populations or in older patients in which transportation are difficult, capillary glucose tests could be used as a screening test to detect more patients with DM in this age range.

The strengths of this study lie in the large number of participants from different populations, including indigenous, of San Luis Potosi.

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THE JOURNAL OF LATIN AMERICAN GERIATRIC MEDICINE ORIGINAL ARTICLE

Systematic review and meta-analysis of frailty prevalence in Mexican older adults

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Abstract

Introduction: *Frailty is a common condition in older adults, which consists in an increased vulnerability to stressors and a higher frequency of adverse outcomes, after this exposure.* **Objective:** *The objective of this study was to conduct a systematic review and meta-analysis on the prevalence of frailty in Mexican older adults and explain the causes of heterogeneity.* **Methods:** *Systematic review of the literature on the prevalence of frailty in Mexican older adults including gray literature. Meta-analysis with random effects was performed for all studies and subsequently stratified by potentially explanatory characteristics (type of tool, sample, sex of the participants, type of publication, age of the participants, etc.). Period prevalence, confidence intervals (CI), and heterogeneity are reported.* **Results:** *Of a total of 16 studies included with 18,965 older adults, the prevalence of frailty was 31.2% (95% CI: 24.9-37.4%), with a heterogeneity of 98.7%. When classifying frailty with subjective tools, the lowest heterogeneity was obtained (78.8%), with a prevalence of 38.6% (95% CI: 35.9-41.3).* **Conclusion:** *The significant variability of the prevalence between the studies is increased by some individual characteristics included resulting in a variety of definitions, diagnostic tools, and interpretations in relation to the frailty of research.*

Key words: *Older adults. Geriatrics. Frailty.*

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INTRODUCTION

Frailty is a common condition affecting older adults that consist in an increased vulnerability to stressors with consequently higher adverse outcomes when exposed to those stressors[1]. Different reports have shown a great difference between the prevalence of frailty in the older adult population. Specifically, a systematic review on this topic described prevalence going from 3% to 40%[2]. Despite these heterogeneous results, researchers and clinicians continue to push a "unified" concept of this topic[1,3]. This is depicted in the increasing number of manuscripts about frailty in the web search engines (e.g., 79 manuscripts in 1990 for the term frail elderly in PubMed rising up to 1004 at the end of 2017). Furthermore, Mexico is a peculiar case, it is a middle-income country, and in comparison, with similar countries in Latin America, it has outstanding research on the matter[4-6].

Two main methods are the most widely used to classify frailty nowadays, Fried's frailty phenotype and Rockwood's frailty index[7,8]. However, some methodologic problems have arisen - particularly from the phenotype- and were accurately described in a recent

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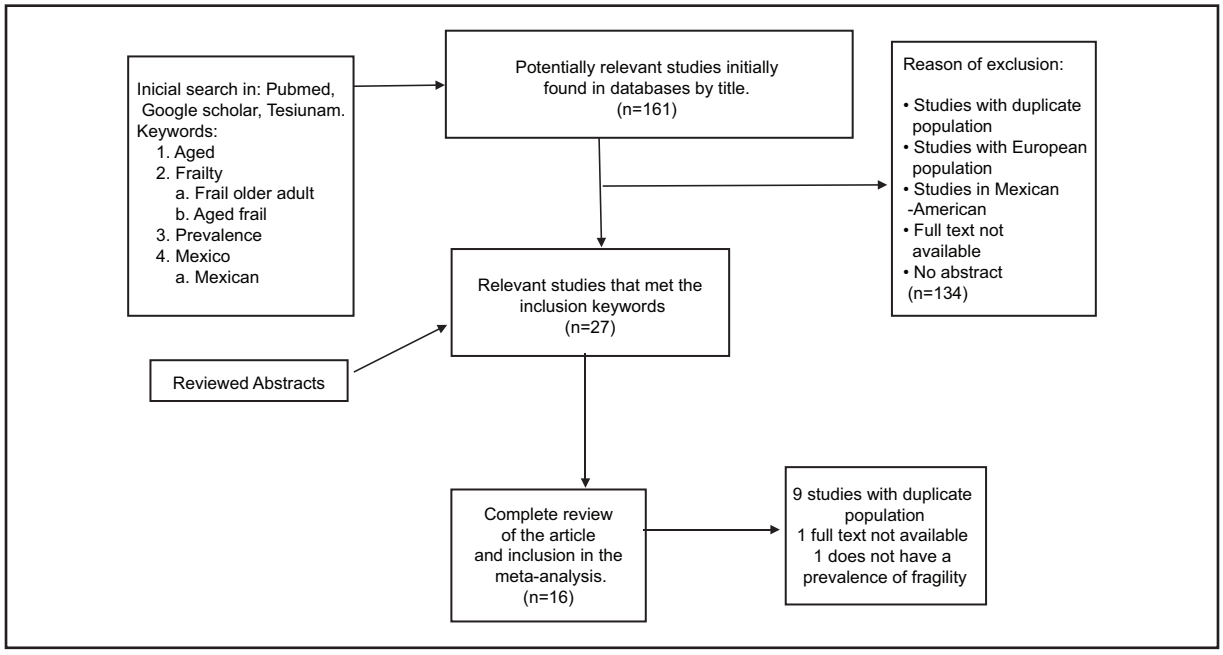

Figure 1. *Flowchart of literature systematic review of frailty prevalence in Mexican older adults*

report by Theou et al. showing that there are over 200 versions of the frailty phenotype reported in the geriatric literature[9]. This problem could be of a greater magnitude when it comes to different sociocultural settings, or, in other words, there is an increased risk of getting "lost in translation"[10]. In this scenario, issues of reproducibility, reliability, and basic understanding of a concept are endangered by an incorrect taxonomy.

Our hypothesis is that even though the analysis is circumscribed to a specific country, there still are many differences that cannot be accounted to the sociocultural background of the older adults being studied, but rather other various facts. Therefore, the aim of this report is to review the literature that includes frailty's prevalence in Mexican older adults and to explain the possible heterogeneity of the reported prevalence perceived among this topic in a specific population.

METHODS

A systematic review of the literature was done to extract those studies where frailty prevalence was explicitly described in Mexican older adults. We included those studies that accounted only for those older adults living inside the Mexican Republic, excluding reports of Mexican Americans or performed by Mexican researchers but in other population. Selected studies and the flow to arrive to them are depicted in figure 1.

In brief, general characteristics of the selected studies regarding number of subjects, year of the data, and other additional information were considered. Afterward, once we had the selected studies, prevalence and limits of the confidence intervals (CI) were abstracted from each text. However, if the information was not available, it was estimated by the total number of subjects, and if this was not available the corresponding author of the study was contacted to retrieve this information. The meta-analysis was summarized in forest plots, giving both individual and group data in addition to the relevance of each study. Fixed effects were first estimated, if the heterogeneity was >15%, a random effect approach was used. To analyze heterogeneity, a first step stratified analysis for characteristics of the studies was done that included the following characteristics: quality of the text (see below for description), year of publication of the study, mean age of the population, classifying tool used, use of objective measurements, type of manuscript (thesis or published article), and origin of the sample (national or local).

Literature search

A systematic review of the literature was done to extract those studies where the prevalence of frailty is explicitly described in Mexican seniors.

The included studies were only of older adults living in the Mexican Republic, who met the requirements for this research and had informed consent; excluding Mexican-American reports or reports of Mexican

Table 1. General characteristics of included studies

Year	Author	Diagnostic	Type of study	Average age	Sample	Prevalence (%)	Strobe
2014	Sánchez-García	Fried frailty phenotype	Original article	70.6	1,933	15.7	23
2015	Aguilar-Navarro	Fried frailty phenotype	Original article	68.7	5,644	37.2	21
2015	Manrique-Espinoza	Fried frailty phenotype	Original article	Not defined	558	6.6	19.5
2009	Kameyama	Rockwood's frailty index	Thesis	76.03	785	14.6	21
2014	Payan Fierro	Rockwood's frailty index	Thesis	74.6	116		21
2014	Ledesma Ramírez	Fried frailty phenotype	Thesis	69.4	40	48	16
2014	Esteban Hernández	Rockwood's frailty index	Thesis	73	137	22.4	21
2015	Pérez Moreno	Fried frailty phenotype	Thesis	70.5	135	48	22
2009	García González	Rockwood's frailty index	Original article	73	4,082	35	21
2015	Rivera Hermosillo	Fried frailty phenotype	Thesis	77	91	44	19
2009	Castañeda Morales	Fried frailty phenotype	Thesis	69.5	131	12.2	18
2012	Ruiz-Arregui	Fried frailty phenotype	Original article	83.6	1,294	14	21
2012	González Domínguez	Fried frailty phenotype	Original article	70.7	253	44.3	19.5
2014	Martínez Arroyo	Edmonton scale	Original article	76.6	446	35.7	17
2016	García-Peña	Fried frailty phenotype	Original article	69.8	2,009	24.9	20
2008	Alvarado	Fried frailty phenotype	Original article	Not defined	1,311	39.5	20

authors based on populations from other countries.

To do so, we used different databases of medical literature such as PubMed, Google Scholar, and TESIUNAM. In the first stage of the search, we used the terms contained in the thesaurus of PubMed (MeSH) "aged," "frailty," "prevalence," "frail older adult," "Mexico," "Mexican;" 161 matches were found with the terms derived from the research question.

Study selection

Once the initial search was completed, two researchers (geriatricians) reviewed the summaries of the studies and only those that had the prevalence of frailty in Mexico were included in the study, the others were eliminated. If the randomly adjusted concordance of the selection of abstracts was < 0.7, a third (non-geriatrician) opinion was sought for those abstracts in which discrepancy existed, and their opinion was taken as final, figure 1.

Data extraction and methodology quality assessment

Seeing that, the last stage of the bibliographic research was thoroughly reviewed by two geriatricians and a qualification was awarded through the strengthening the reporting of observational studies in epidemiology (STROBE) checklist for observational epidemiological studies. According to their STROBE, high-quality studies were considered those who had STROBE scores ≥20 points and of low quality those with scores < 20.

Meta-analysis

First, the fixed effects were estimated first and if the heterogeneity was >15%, a "random effects" model was used. To analyze the heterogeneity, a primary analysis was made to assess the characteristics of the studies including quality by the STROBE score, publication date of the study, mean age of the population, classification tool, objective measurements used, the provenance of the sample; whether local or national, and finally, the type of publication (thesis or original article). Point prevalence and 95% CI were reported for the whole studies and for the stratified groups, in addition to I^2 to measure heterogeneity and its correspondent significance.

RESULTS

From the terms "aged," "frailty," "prevalence," and "frail older adult," we found 161 matches. Of these titles reviewed, 27 papers were selected, which were reviewed by two independent experts and obtained a concordance above 0.7, leaving for the final review a total of 16 papers (Table 1). From the systematic review

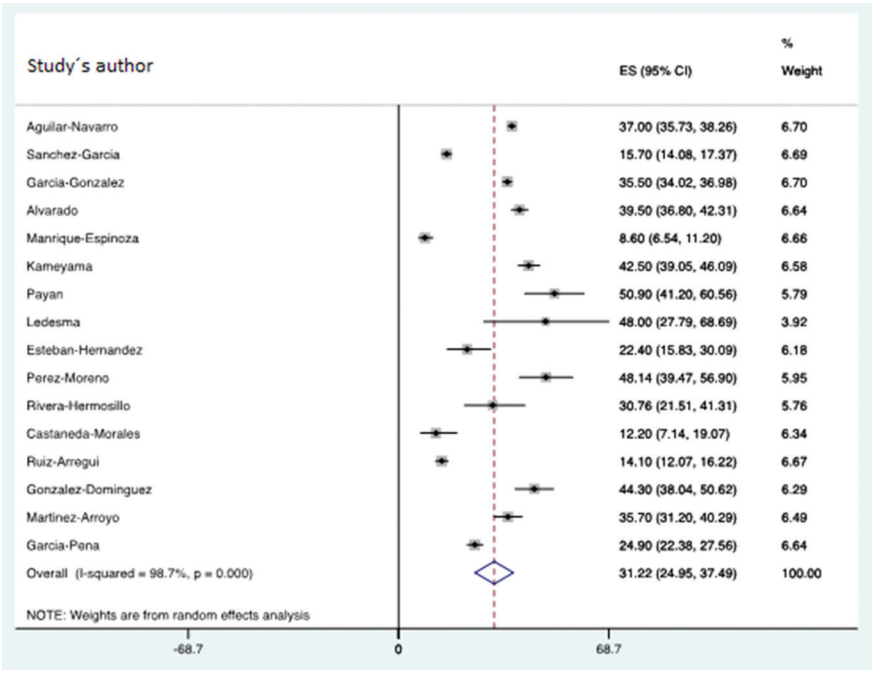

Figure 2. *Forest plot of the 16 studies of the prevalence of frailty in Mexican older adults with confidence intervals and heterogeneity measurement.*

previously described, the meta-analysis was done as a whole and by stratification of certain characteristics.

The prevalence of frailty is shown in figure 2, with wide values ranging from 8.6% reported in Manrique-Espinoza's original article to 50.9% in Payan's thesis. A total heterogeneity was found among the 16 studies of 98.7%, which as a whole studied 18,965 adults <60 years. It was found that the Fried phenotype was used in most of the reviewed studies (11 studies) and found a heterogeneity of 98.9% among these. Finally, the prevalence of this condition using the former tool was from 8.6% to 50.9%.

In addition, four studies used the Rockwood index as a diagnostic tool, with a ranging prevalence varying between 22.4% and 42.5%.

Consequently, the studies were grouped with respect to their realization with national or local population, achieving a heterogeneity of 99.2% and 98.3%, respectively.

Moreover, we also analyzed the impact of the quality of the studies according to their STROBE rating with respect to the reported prevalence. The studies considered of high methodological quality had a heterogeneity of 98.9%, whereas for those of low methodological quality, it was 97.6%. The corresponding Forrest Plot can be checked in figure 3. What's more, the studies were grouped with respect to the use of objective tools, where it was found that when using at least one of these the heterogeneity was 98%, and when none was used, heterogeneity was 78%. Refer to figure 4.

Finally, when calculating the heterogeneity of the agglutinated studies by the mean age of the participants, as well as the sample number and sex, the heterogeneity varied little (forest plots available upon request).

DISCUSSION

A wide range of frailty prevalence was found ranging from 8.6% to 50.9% (when analyzing raw results) and with the meta-analysis of 31.2% (95% CI: 24.9-37.4%), with a heterogeneity of 98.7%. These disparate findings are consistent with those found in the systematic review published by Collard et al.[2] Furthermore, regarding the prevalence of frailty in those elderly residents dwelling in the community, very wide prevalence values were found ranging from 4% to 59.1%. Referring now to the study published by Gray et al. on frailty in low- and middle-income countries (including Mexico), prevalence ranging from 14% to 61.7% was also reported. Besides, in the systematic review of the prevalence of frailty in Choi, a prevalence of community residents ranging from 4.9% to 27.3% was characterized[11].

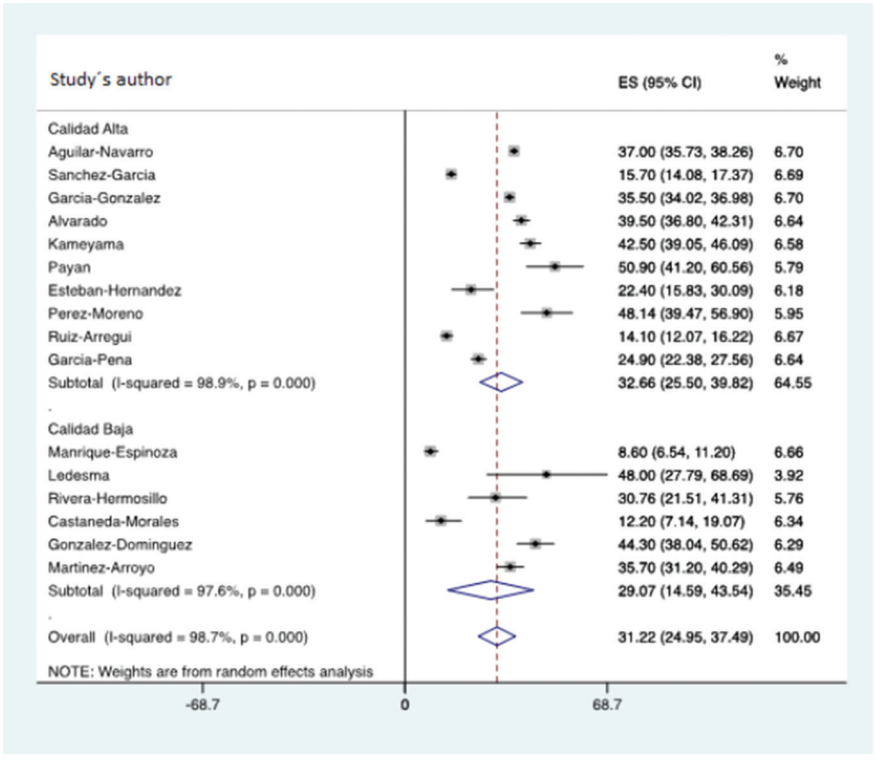

Figure 3. *The heterogeneity of fragility prevalence according to the methodological quality of the study measured with STROBE.*

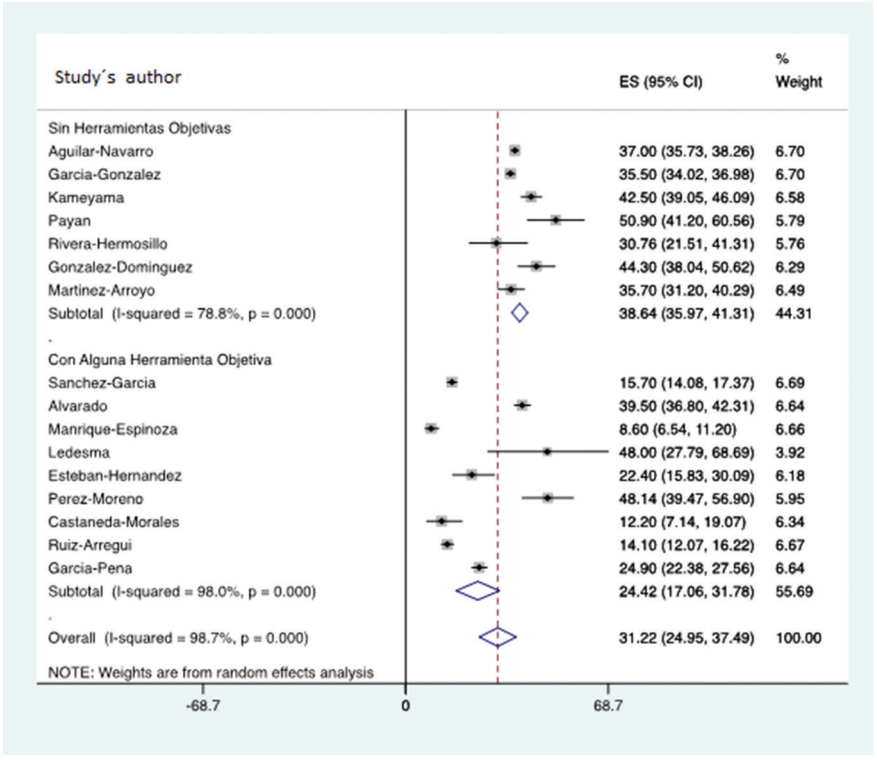

Figure 4. *Forest Plot showing prevalence of fragility and measurement of heterogeneity according to the use or not of objective tools for the diagnosis of fragility*

On the one hand, the main diagnostic tool to determine the prevalence of frailty in this systematic review is the one performed by Gray et al. and the review published by Collard the Fried phenotype was the most used. On the other hand, the systematic review of Choi was based only on studies that used the Fried phenotype as a diagnostic tool[12].

In addition, it is well known that the female sex confers an increased risk of being frail. In the systematic reviews observed by Collard and Gray, the majority of the population in the texts was female, as in ours, also corresponding to the highest prevalence reported in the investigations. However, this variable is not considered to be particularly relevant since it shows a heterogeneity of 98.7%.

In our meta-analysis, the Fried phenotype was the tool that presented the greatest heterogeneity (98.9%); contrary to what was found by Collard et al., who found that the wide range of results was reduced when Fried's phenotype was used, with a prevalence of frailty varying from 4.0% to 17.0%; however, the work of Collard to not be meta-analysis does not count on the measurement of heterogeneity.

Plus, the most interesting finding of this systematic review and meta-analysis is the reduction of the heterogeneity of the results by not using objective measures within the diagnostic criteria of frailty, contrary to what was found by Collard et al., who found out that in studies that used broad definitions or objective measurement instruments, the prevalence ranges were wider, starting from 4.2% to reaching 59.1%, alike the author Choi who in his systematic review defines that the variation of the prevalence is due to differences in the subjective nature of some diagnostic tools[12].

Besides, the systematic review by Olga Theou et al.[9] published in 2015 established that the variability was determined in the way that the frailty phenotype criteria were assessed. In this study, they found 262 variations of the Fried phenotype, among these, the prevalence of frailty ranged from 12.7% to 28.2%. The author, as in Collard's and our study, found that the highest estimates of frailty were produced by tools that included self-reports compared to the use of objective performance measures.

Finally, the majority of studies which used no objective tool used the main functional measurement scales (Katz and Lawton), which are standardized and provide us with an idea of the degree of disability. This helps us to infer that some of these studies reflect the measurement of disability, which although considered within the spectrum is not synonymous of frailty. A problem already proposed by Theou et al., which concludes that disability overlaps with frailty, adding to the latter the capacity to predict mortality and other negative outcomes.

First, its essential to denote the existence of a significant variation with respect to the prevalence reported in the reviewed studies, which increases by the hand of all the individual characteristics reviewed (type of tool, sample number, sex of participants, type of publication, age of participants, etc.), resulting in the reflection of the great heterogeneity of definitions, diagnostic tools and interpretations in relation to the frailty among researchers.

Second, to have an efficient allocation of resources, an accurate definition of the problem is needed. In addition, researchers should make every possible effort to translate knowledge since the beginning of a research question. Last but not least, frailty should be considered a priority in health research and a continuous improvement in methodology to address frailty questions is very important.

CONCLUSION

The wide range found in the prevalence of frailty is mainly due to differences in the definitions used in these works as well as in tools used to elaborate those definitions.

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THE JOURNAL OF LATIN AMERICAN GERIATRIC MEDICINE ORIGINAL ARTICLE

Influenza and pneumococcal vaccination and physical disability in elderly ambulatory patients from a first level health-care center

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Abstract

Background: *Aging population presents a decreased function of the immune system related to age known as immunosenescence; therefore, elderly population is associated to an increased susceptibility to infections such as influenza and pneumococcal pneumonia. Vaccination is one of the most cost-effective strategies because they offer a cheap alternative of preventing potential morbidity. Geriatrics syndromes like disability could be related to an increased morbidity and mortality.* **Objectives:** *The objectives of this study were to determine the frequency of vaccination schemes (VS) and its associations between physical disabilities (PDs) in elderly ambulatory patients from a first level health-care center.* **Materials and Methods:** *A cross-sectional study including 264 participants aged 60 or older recruited from a first level health-care center in 2015. Participants underwent a comprehensive geriatric assessment, with which the diagnosis of PD, and VS were obtained. Regression analysis variables were determined to establish the association between the VS and PD.* **Results:** *Mean age was 73 years (SD ±6), women accounted for 60%. The 36% reported current seasonal influenza vaccine, 35% for pneumococcus vaccine, and 17% the presence of both vaccines. The presence of an updated VS against pneumococcus and influenza showed a positive association for some physical functions (To being able to extend arms at shoulder level: OR = 2.8, 95% CI: 1.28-6.15, p < 0.05).* **Conclusion:** *This study showed that the frequency of the current VS is low in Mexican elders and that vaccinated elderly has a lower risk of PD. These results suggest the importance of monitoring VS, as they seem to have an impact on health status of the elderly, per the promotion of successful aging.*

Key words: *Disability Influenza. Pneumococcal vaccination. Elderly.*

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INTRODUCTION

People aged 60 and older are about 11% of the worldwide population and it is expected to be about 22% by 2050, elderly population is associated to an increased susceptibility to infections such as influenza and pneumococcal pneumonia[1,2]. Furthermore, turnover of the demographic structure, it is followed by an increase in geriatric syndromes (GS)[3,4]. Disability and immobility are some of the more prevalent GS[5].

Influenza virus is responsible for 250,000 deaths yearly and it is associated with 3-5 million cases of severe infection[6]. *Streptococcus pneumoniae* causes 400,000 hospitalizations each year and it has a case-fatality rate of 5-7%[7]. Age-based approach in vaccination strategies seems to be the best option to protect the aging population[8-12]. Vaccination of elderly people has been recommended to limit transmission; however, it is possible that vaccination has a positive impact on the maintenance of health evolved through outcomes such as physical

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functionality. However, the relationship between disability and vaccination is not simple and unidirectional[13-15]. Some results of trials have suggested that vaccination continues to provide benefits among elderly people with disability and even that the presence of frailty does not diminish the probability of being vaccinated[16-17].

Although influenza and pneumococcal vaccination among elderly people is a critical public health concern, outcomes other than mortality associated with influenza and pneumococcal vaccination have not been thoroughly studied. There are only a few studies that explored the association between disability and vaccination and the results were inconclusive[13-18].

The aim of this study was to determine the frequency of vaccination against influenza and pneumococcus, and its associations between physical disabilities (PD) in adults aged 60 or older, attending at the first level health-care center in Mexico.

MATERIALS AND METHODS

Study population

A cross-sectional study including participants aged 60 or older, which were consecutively recruited from a first level health-care center belonging to the Mexican Institute of Social Security in Jalisco, Mexico (which attended 1719 consultation peer year to adults over 60 years of age) between September 2015 and April 2016. Subjects were invited to voluntarily participate in the study and underwent a comprehensive geriatric assessment (CGA) by trained staff, and VS information was also obtained. Subject who did not complete the questionnaire responses were excluded from the study. The Local Ethics Committee reviewed and approved the study protocol.

Assessments

Dependent variables

Disability and immobility were investigated as outcome.

The Nagi scale for disability was performed for the present study. A score of 1 was given for each Nagi item that the subject had at least a little difficulty with pulling or pushing large objects such as a living room chair; stooping, crouching, or kneeling; lifting or carrying weights over 10 pounds, like a heavy bag of groceries; reaching or extending arms above shoulder level; writing or handling or fingering small objects. The responses were no difficulty at all, a little difficulty, some difficulty, and a lot of difficulty, just unable to do it. Total score equals number of items (five) with a response other than "no difficulty at all"[19].

Immobility risk

The questions from the Rosow-Breslau Functional Health Scale assessed three gross mobility items (walking half a mile, climbing stairs, and doing heavy work around the house) to make high risk of immobility diagnosis[20].

Vaccination schemes (VS)

Three VS were investigated as independent variables: seasonal influenza vaccine, pneumococcal vaccine, and simultaneous presence of both in the past year before sample collection.

The composition of the seasonal influenza vaccine 2013-2014 applied by the Mexican Institute of Social Security was as follows: hemagglutinin A/California/7/2009(H1N1), hemagglutinin A/361/2011/(H3N2), and hemagglutinin B/Massachusetts/2/2012. The pneumococcal vaccine used by the subjects consisted of 23 different serotypes of capsular polysaccharides, containing 25 micrograms of each (total 575 mcg) dissolved in an isotonic solution. Each polysaccharide was obtained separately and combined in the final product (thimerosal with a final concentration at 0.01%). In cases, where the questions have been vaccinated the past year against influenza and have been vaccinated in the past 5 years against pneumococcus were affirmative, proceeded to make a visual confirmation through the national registry of vaccines by personal vaccination card.

Covariates

Sociodemographic variables included age, sex, schooling, marital status, and morbidity variables.

Smoking status was categorized as current or not. All participants were asked whether they had a physician's diagnosis of any of 19 chronic diseases per the World Health Organization's International Classification of Diseases-10[21]. Impairment in basic activities of daily living (ADL) and instrumental ADL (IADL) was used to identify disability in the participants[22,23].

Statistical analyses

Baseline descriptive data for the final sample are shown as means and standard deviations for

Table 1. Prevalence of influenza vaccination according to the sociodemographic and clinical characteristics

Variable (total)	Vaccination status		
	Vaccine versus influenza (previous 1 year) *n*, (%)	Vaccine versus influenza (previous 1 year) *n*, (%)	*p*
Sex	Yes	No	
Female (158)	52 (33)	106 (67)	0.138
Male (105)	44 (42)	61 (58)	
Age (years)			
60-74 (175)	71 (41)	104 (59)	0.10
75-84 (84)	23 (27)	61 (73)	
85+ (4)	2 (50)	2 (50)	
COPD			
Yes (6)	2 (33)	4 (67)	0.87
No (257)	94 (37)	163 (63)	
Disability (Barthel)			
Yes (7)	1 (14)	6 (86)	0.22
No (254)	93 (37)	161 (63)	
Lawton (male)			
Yes (29)	8 (28)	21 (72)	0.30
No (233)	87 (37)	146 (63)	
Lawton (female)			
Yes (123)	43 (35)	80 (65)	0.68
No (139)	52 (37)	87 (63)	

COPD: chronic obstructive pulmonary disease

continuous variables and frequencies (%) for categorical variables. X^2 test or Fisher's exact test was used as appropriate. Logistic regression was used to determine the association strength for the prevalence of disability and immobility, and association with VS variables was evaluated by OR.

All analyses were evaluated using 95% confidence intervals and $p < 0.05$ was considered statistically significant. Statistical analyses were conducted using Stata statistical package for Windows® (StataCorp., Texas, IL, v. 14).

RESULTS

The final sample was made up of 264 individuals aged 60 years or older; women accounted for 60%, and the mean of age was 73 (SD ± 6). The main baseline sociodemographic and geriatrics characteristics are presented in table 1 and 2 between those characteristics and the distinct vaccines schemes. Of the total, 47% of women and 11% of men presented one or more disabilities in the ADL scale, respectively. Barthel scale scores mean was 89 (SD ± 0.94). A total of 7% classified at high risk of immobility according to Rosow-Breslau scale.

The VS variables were as follows: 36% reported seasonal influenza vaccine the previous year and 35% reported the vaccine against pneumococcus in the past 5 years. Only 17% reported the presence of both. The prevalence to be vaccinated against seasonal influenza and pneumococcus at any other time and in adult life was 90% and 80%, respectively.

Univariate analysis

The results from the univariate regression analyses of the associations between baseline VS variables and disability and immobility risk are presented in table 3. Simultaneous presence of both vaccines showed significance for being unable to walk half a mile (OR = 0.46, 95% CI: 0.223-0.98), as well for being able to extend arms at shoulder level (OR = 2.8, 95% CI: 1.28-6.15). Vaccine against pneumococcus isolated increased the likelihood of being able to lift or load objects of more than 10 pounds (OR = 2.42, 95% CI: 1.38-4.21).

DISCUSSION

The results showed an association between adult vaccines schemes and immobility risk and physical performance in Mexican elders. By another hand,

Table 2. Prevalence of pneumococcus vaccination according to the sociodemographic and clinical characteristics

Variable (total)	Vaccination status		
	Vaccine versus pneumococcus (previous 5 years) *n*, (%)	Vaccine versus pneumococcus (previous 5 years) *n*, (%)	*p*
Sex	Yes	No	
Female (158)	49 (31)	109 (69)	0.08
Male (106)	44 (42)	62 (58)	
Age (years)			
60-74 (176)	68 (39)	108 (61)	0.12
75-84 (84)	25 (30)	59 (70)	
85+ (4)	0 (0)	4 (100)	
COPD			
Yes (6)	0 (0)	6 (100)	0.06
No (258)	93 (36)	165 (64)	
Disability (Barthel)			
Yes (7)	3 (43)	4 (57)	0.64
No (255)	88 (34)	167 (65)	
Lawton (male)			
Yes (29)	10 (34)	19 (65)	0.95
No (234)	82 (35)	152 (65)	
Lawton (female)			
Yes (123)	43 (35)	80 (65)	0.99
No (140)	49 (35)	91 (65)	

COPD: chronic obstructive pulmonary disease

Table 3. Regression logistic analyses of immobility and disability risk by vaccination schemes

Variable	Vaccination schemes		
Mobility (Rosow-Breslau)	**IV OR (95% IC) *p***	**PV OR (95%IC) *p***	**IV+PV OR (95%IC) *p***
Able to do heavy work?	1.12 (0.67-1.88) 0.66	1.7 (0.99-2.83) 0.05**	1. 8 (0.89-3.6) 0.10
Able to walk up and down stairs?	0.845 (0.38-1.89) 0.681	0.88 (0.41-1.89) 2.13	1.17 (0.38-3.5) 0.78
Able to walk a half a mile?	0.83 (0.443-1.56) 0.57	0.70 (0.37-1.3) 0.26	0.46 (0.223-0.98) 0.04*
Disability (Nagi)			
Pulling or pushing large objects	1.23 (0.70-2.15) 0.46	1.58 (0.89-2.82) 0.11	1.3 (0.67-2.8) 0.4
Stooping, crouching, or kneeling	1.01 (0.59-1.73) 0.96	1.6 (0.91-2.7) 0.1	1.38 (0.62-2.7) 0.5
Lifting or carrying weights over 10 pounds	1.44 (0.85-2.44) 0. 17	2.42 (1.38-4.21) 0.002*	2.80 (0.67-2.8) 0.4
Reaching or extending arms above shoulder level	0.826 (0.28-2.4) 0.725	0.58 (0.204-1.6) 0.31	2.8 (1.28-6.15) 0.01*
Writing or handling or fingering small objects	1.70 (0.45-6.47) 0.43	0.72 (0.224-2.35) 0.6	0.96 (0.20-4.5) 0.96

IV: influenza vaccine, PV: pneumococcal vaccine
**$p = 0.05$
*$p < 0.05$

to the best of our knowledge, this is one of the first studies to associate VS and disability and immobility in Mexican elders. These results demonstrate that the presence of updated immunization schedules in the elderly is still low in Mexico, even among users of regular public health services provided by the Institute of Social Security, the rates of vaccines evaluated separately and simultaneously are lower than those observed in other developing countries. Our study also showed an association for the risk of immobility and PD in Mexican elderly who were recently vaccinated against both seasonal influenza and pneumococcus infections.

We demonstrate that influenza vaccination rates are higher than pneumococcal vaccination rates, which coincide with the findings of Brownfield, in a study made in South Carolina[24]. We believe that the main explanation for this phenomenon is probably because the 5-year gap between pneumococcal vaccines makes it more difficult for elderly patients to follow the vaccination schedule[25].

Our study showed that vaccinated elderly has a lower risk of disability, which is similar to what other studies have shown - regarding function and mobility - and suggests that there could be a relationship between influenza and pneumococcal vaccination and the risk of decline in physical performance. For example, a study conducted in Australia found that vaccine-preventable diseases such as influenza and pneumococcal infections can lead to lower activity and function, which eventually may conduce to different kinds of disability or impaired mobility[26]. Chan demonstrated that the vaccine efficacy in reducing mortality declined in nursing home residents with increasingly impaired functional status[27]. Barker also found in a case–control study that influenza causes a decline in physical functions in more than 9% of survivors. Among surviving case subjects, 25% experienced decline in at least one major function (bathing, dressing, and mobility)[28]. The explanation behind this association seems to be the vulnerability caused by the infection itself, the worsening of previous chronic conditions and permanent sequelae from the infection[26].

The reason why no other significant associations were found in this study is possibly because the functionality was measured with the Lawton and Barthel scales, and both require the presence of other factors such as cognitive impairment, weak social network, and among others, per cause different degrees of disability.

Our study has several limitations. First, information on PD was self-reported, and the findings must be interpreted with caution. Further longitudinal studies including objective measures of PD (e.g., dynamometry and walk speed) should be developed to confirm or refute these findings. Another limitation of this study was the loss of follow-up; this could limit generalization of the findings. The possibility of reverse causality in the direction of the association between SV and physical performance should not be ignored. Finally, other potential covariates and effect modifiers were not included (e.g., energy intake and severity of disease) and must be taken into account when interpreting these findings. Although it was not the objective of the study, our analysis did not consider many other confounding variables; all these factors are well known for their influence on the development of disability. However, the main strengths of this study include DP screening, which was done with standardized tests, and the obtaining of the information of the VS through a highly reliable official registry.

CONCLUSION

This study showed that the prevalence of actualized VS is low in west Mexican elders. The establishment of a culture of primary prevention in the health of the elderly, through habits such as vaccination in old age, and its potential positive effects beyond the prevention of systemic infections are one of the great challenges of geriatrics and public health around the world. These results suggest the importance of monitoring VS, as they seem to have an impact on health status of the elderly. We think that CGA which includes the identification of elderly at risk and even without an updated vaccination schedule, it is a tool to promote health improvements through prevention and to avoid the development of immobility and disability in elders. However, these results must be replicated in a more extensive cohort with a longitudinal approach.

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INSTRUCTIONS FOR AUTHORS

The Journal of Latin American Geriatric Medicine is the official divulgence medium for the Mexican National College of Geriatric Medicine. It's a periodic publication that responds to current needs in Latin American geriatric medicine and represents a joined effort aimed at making geriatrics a vanguardist specialization with the scientific importance it deserves. It publishes text in English and Spanish on topics related to geriatrics in form of editorials; revision, original, short, indicative and actualization articles; as well as news; bibliographic reviews and letters for the editor.

It is convenient to remember that this journal is a space open to all medical institutions and to contributions from local and foreign researchers, especially those involved with clinical and epidemiologic aspects of problems related to ageing.

Given that English is the main language for scientific communication, papers will be accepted in this language. The maximum number of authors for revision articles is six, and three for short papers. The length must be 5 to 8 pages (from the frontal page to the bibliographic references), plus two tables and one figure.

Style and Format

All manuscripts must follow the regulations established by the International Committee of Medical Journal Editors. The front page must include only the title (in English and Spanish, no more than 90 characters long), the authors' full names with their corresponding academic grade and institutional affiliation, indicating also the corresponding author with the appropriate mailing address, telephone, fax, and email address.

The summary and abstract must be no longer than 150 words and include subtitles that indicate: objective, material and methods, results, and conclusions. For short articles they should be less than 100 words long. Three to six keywords must also be included.

The text must include sections corresponding to introduction, materials and methods, results, and discussion.

Authors are responsible of sending compete bibliographic references and their correct citation within the text. These must be numbered in consecutive order according to the Vancouver system. References to journals include: a) authors' last name(s) and initial(s) (mention all authors when there's six or less; when there's seven or more, include the first six then add "et al"); b) article's full title, using uppercase only for the first letter of the first word (and for proper names); c) the journal's abbreviation as indicated in the index Medicus; d) date published; e) volume; f) page numbers (initial and final) separated by a dash.

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The units of measure must correspond to the International System of Units.

Each table must be sent on a separate page, must include a title and be identified with roman numerals: table I, table II, etc., following the same order in which they appear in the text. Illustrations may be graphs, photos, or diagrams and will be identified with Arabic numerals: figure 1, figure 2, etc. These must also be sent in separate pages, each one with their corresponding title. If the figures include graphs, the data with which they were made must be attached (in print or electronic file).

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Reference Examples

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REQUISITOS PARA SER ASOCIADO TITULAR DEL COLEGIO NACIONAL DE MEDICINA GERIÁTRICA

* Tener el título y cédula profesional de Médico Cirujano, y haber realizado la Especialidad de Geriatría mediante los procesos del Examen Nacional de Residencias Médicas (ENARM) normado por la Comisión Institucional para la Formación de Recursos Humanos para la Salud (CIFRHS) en la República Mexicana o sus similares en el extranjero o haber sido reconocido en su momento para tales efectos por el Consejo Mexicano de Geriatría A.C. con aval de idoneidad por el Comité Normativo Nacional De Consejos De Especialidades Médicas A.C. (CONACEM).

* Tener Cédula profesional de la Especialidad en Geriatría emitida por la Dirección General de Profesiones de la Secretaría de Educación Pública de México.

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* Cubrir la cuota que determine para tal efecto la Asamblea General Ordinaria de Asociados a propuesta del Consejo Directivo.

* Haber sido admitido por la Asamblea de Asociados para formar parte del Colegio. Mayores informes en la página https://nam03.safelinks.protection.outlook.com/?url=www.conameger.org%2Fafiliaciones&data=02%7C01%7C%7Cd5ee26f248a54a557cb908d64f7f639b%7C84df9e7fe9f640afb435aaaaaaaaaaaa%7C1%7C0%7C636783805875499973&sdata=TBiufXiIMlA9LPtjP5SlU9Sa0BO%2BVubNLcVe06XsFbk%3D&reserved=0

Congreso

Nuestro Colegio, tiene en sus afiliados a la mayoría de los médicos geriatras mexicanos certificados. Cada mes de agosto se celebra el Congreso Científico Internacional de Medicina Geriátrica. A partir de la gestión del Dr. Jorge Luis Torres Gutiérrez la sede del congreso salió de la Ciudad de México a destinos como Puerto Vallarta y León, Guanajuato. El próximo congreso será en la ciudad de Mérida, Yucatán del 7 al 9 de agosto del 2019.

Requisitos de talleres, simposios, cursos, congresos, diplomados u otras actividades académicas que soliciten el aval por parte del Colegio Nacional De Medicina Geriátrica (CONAMEGER)

Carta dirigida al presidente de CONAMEGER que justifique y explique los motivos por los que solicita el aval del evento académico a realizar.

Anexar programa del evento que señale fechas, sitio de realización y programa detallado, así como el perfil de asistentes esperados.

El programa académico será evaluado con la finalidad de que el objetivo del evento comparta la misión y visión del CONAMEGER.

La autorización será considerada en la SIGUIENTE reunión de trabajo del Consejo Directivo inmediata posterior a la recepción de la petición, en donde las Comisiones de Honor y Justicia, Servicio Social Profesional, Publicidad y Prensa, y de Estudios Científicos determinaran la procedencia de contar con el aval del CONAMEGER.

Para su aprobación el evento a evaluar deberá contar con al menos un 30% de profesores que sean Colegiados Titulares y/o Colegiados Honorarios del CONAMEGER.

En caso de ser aprobado el aval por el Consejo Directivo del CONAMEGER para el evento solicitado, los organizadores deberán aportar una cantidad específica por día de evento dependiendo del costo de la inscripción:

Evento gratuito: Sin costo
Inscripción 100-499 pesos: $ 1000.00/día
Inscripción 500-999 pesos: $ 2000.00/día
Inscripción 1000-1499 pesos: $ 3000.00/día
Inscripción 1500 pesos ó más: $ 4000.00/día.

En el caso de los eventos académicos realizados por cualquiera de los capítulos estatales del CONAMEGER cumpliendo con los requisitos mencionados podrán recibir el Aval sin costo utilizando el logo del colegio que especifique el capítulo estatal del que se trate.

En el caso de sociedades, asociaciones o colegios filiales al CONAMEGER cumpliendo con los requisitos mencionados podrán recibir el Aval pagando la mitad (50%) de las aportaciones mencionadas.

El aval académico otorgado será exclusivamente para el evento mencionado en el programa y no podrá ser reutilizado sin la aprobación del Consejo Directivo.

La difusión del evento por cualquier medio impreso, digital o electrónico será vigilada por la Comisión de Honor y Justicia quien podrá en todo momento informar al Consejo Directivo para rescindir el aval de CONAMEGER.

NOTA: LA CUOTA CORRESPONDIENTE DEBERÁ PAGARSE AL MENOS 30 DÍAS ANTES DEL EVENTO EN LA CUENTA DEL COLEGIO Y HACERNOS LLEGAR EL VOUCHER DEL BANCO A LA BREVEDAD AL CORREO tesorero@conameger.org

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NUESTRA HISTORIA

Nuestra Historia

2009

El Colegio Nacional de Medicina Geriátrica tiene antecedente con la Sociedad de Geriatras de México, una Asociación Civil de Nacionalidad Mexicana; esta asociación fue fundada en noviembre del 2009 con el objetivo de elevar el nivel académico de los geriatras de México; al frente de esta sociedad, como presidente estuvo el Dr. Jorge A. Reyes Guerrero, durante el periodo 2010-2012.
Al terminar su gestión con éxito, dio lugar a al nueva mesa directiva, la cual fue presidida por la Dra. Sara Gloria Aguilar Navarro en diciembre del 2011 en la Asamblea del Congreso.

2012

En noviembre del 2012, se autorizó el cambio de Sociedad a Colegio, más adelante, luego de la terminación de trámites ante la Secretaria de Economía y la Dirección de Profesiones de la Secretaría de Educación Pública de México, en sesión de negocios de la Sociedad del Congreso Nacional del año 2013, se realiza el cambio a Colegio de Medicina Geriátrica, el cual , para fines de integración extraoficial se denominó Colegio Nacional de Medicina Geriátrica (CONAMEGER).

2014

Al ser Colegio de Medicina Geriátrica, la primer presidente fue la Dra. Sara Gloria Aguilar Navarro, seguida de la Dra. Ivonne Becerra Laparra en el periodo de 2014-2016. Durante el bienio 2016-2018, el presidente fue el Dr. Jorge Luis Torres Gutiérrez. Actualmente quien preside el Consejo Directivo en el periodo 2018 – 2020 es el Dr. Miguel Flores Castro.

Boletín

En febrero del 2014, nace el Boletín de Medicina Geriátrica de México, el cual responde a las necesidades actuales del ramo de la geriatría siendo la única publicación periódica a nivel nacional. La revista se internacionaliza y cambia de nombre a "The Journal of Latin America Geriatric Medicine" editada electrónicamente ISSN: 2463-4616, siendo la editora en jefe la Dra. Sara Gloria Aguilar Navarro; quien ha logrado impulsar la revista con publicaciones en idioma inglés, contenido de autores nacionales e internacionales, siendo de libre acceso y ya indexada e incluso con artículos citados en Pub Med.

Páginas

Además de la revista, se cuenta con nuestra página web: https://nam03.safelinks.protection.outlook.com/?url=www.conameger.org&data=02%7C01%7C%7Cd5ee26f248a54a557cb908d64f7f639b%7C84df9e7fe9f640afb435aaaaaaaaaaaa%7C1%7C0%7C636783805875499973&sdata=KRosBahYQeeMYMIo%2BkDis0tQXfFbLQzXIJre9wEMZTE%3D&reserved=0 como otro medio de difusión de las actividades del Colegio, en la cual se transmiten en vivo las sesiones mensuales de la sede oficial, mismas que posteriormente quedan a disponibilidad de las personas interesadas. De este sitio también se pueden descargar gratuitamente los números de la revista "The Journal of Latin America Geriatric Medicine". El Conameger también está presente y activo en las redes sociales facebook y twitter.

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DEL COLEGIO NACIONAL DE MEDICINA GERIATRICA

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