SAGE Open Medicine
Volume 12: 1–9

DOI: 10.1177/20503121241255000
journals.sagepub.com/home/smo
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Factors associated with frailty among older individuals with chronic diseases: A multicenter study

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Abstract

Objective: Frailty is a syndrome that predisposes older individuals to adverse health outcomes, such as disability, dependence, falls, hospitalization, post-operative complications, and poor health in general. This study aimed to identify factors associated with frailty in older people with chronic diseases in Colombia.

Methods: A cross-sectional study was conducted with a nonprobabilistic sample of 230 older people (aged ⩾60 years) from four Colombian cities. Frailty was based on Fried's phenotype (frail defined as having ⩾3 criteria). Comorbidities were classified based on Charlson's Comorbidity Index and key questionnaires for activities of daily living (ADLs) were evaluated.

Results: Most were female (57.8%) with a mean ± SD age of 71.9 ± 8 years. Among them, 27.4% were frail and 58.7% were prefrail. Female gender, age ⩾75 years, low educational and socioeconomic level, dependence on ADLs, and cognitive impairment were associated with higher odds of prefrailty/frailty.

Conclusions: Prefrailty and frailty are common among older people with chronic diseases in Colombia. This syndrome is associated with social and health-related conditions, which should be addressed when providing care for these patients.

Keywords
Frailty, chronic disease, daily activities

Date received: 7 February 2024; accepted: 26 April 2024

Introduction

Frailty is a dynamic concept extending beyond disability, comorbidity, or advanced age. It represents a clinical syndrome characterized by a reduction in the physiological reserve leading to diminished resistance to internal and external stressors. This vulnerability stems from the progressive deterioration of various physiological systems. Consequently, frail individuals are more susceptible to adverse health outcomes, including disability, hospitalization, falls, fractures, dependence, institutionalization, post-operative complications, and overall poor health.[1,2]

As described by Fried et al.,[3] there is an interplay between disability, comorbidity, and frailty. They mention that among frail patients, 27% had a disability (with or without comorbidity) in at least one activity of daily living (ADL), 68% had

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a comorbidity (with or without disability), and 21% had a combination of disability and comorbidity. Despite their co-occurrence, these should be considered different conditions. Furthermore, the research delves into exploring the interactions of health conditions beyond traditional diseases, including factors such as strength, balance, vision, hearing, biomarkers, and hormones.[2]

Frailty is not solely dependent on the presence of diseases or functional capacity. Rather, these health conditions can sometimes mask frailty, especially in the case of noncommunicable diseases (NCDs). NCDs can either cause or accelerate the development of frailty. This association has been observed in 25%–62% of individuals with cardiovascular diseases (CVDs)[4] and 14% of those with chronic kidney disease (CKD).[5] Furthermore, aging involves gradual and irreversible physiological changes that coupled with an inadequate lifestyle increase the susceptibility to developing NCDs. If not treated appropriately and promptly in older individuals, NCDs can lead to complications and sequelae that affect functional independence.[6,7] Concerningly, NCDs tend to occur simultaneously in older people, amplifying the risk of disability and mortality compared to a single disease. Hence, frail older individuals with NCDs face a heightened risk of complications.

The prevalence of frailty varies and depends on multiple factors, including the definition or criteria employed, the characteristics of the population (e.g., age), or the geographical location. Based on Fried's phenotype[1] (defined as ⩾3 of the following criteria: involuntary weight loss, low grip strength, slow gait, low physical activity, and exhaustion), the prevalence of frailty among 65-year-old individuals varies between 4% and 59% globally.[8] In Latin America, estimates suggest that frailty affects between 7.7% and 39.3% of older people.[9]

The Survey on Health, Well-Being, and Aging in Colombia (SABE Colombia) survey examined frailty in a subsample of 4474 older individuals from urban and rural areas revealing that 17.9% of older individuals were frail based on Fried's phenotype. This syndrome was associated with factors, including age, sex, education, income, comorbidity, and adverse childhood conditions.[10] Importantly, 84.8% of older individuals experienced more than one NCD, with high blood pressure, depressive symptoms, visual problems, and hearing problems being the most common. The survey concluded that frailty is a common and multifactorial syndrome in Colombia's older population, closely related to NCDs, and emphasized the need for comprehensive and personalized care.[11]

Aligned with the observations from the SABE Colombia Survey, we aimed to identify the factors associated with frailty in older individuals with chronic diseases across four cities in Colombia. The identification of these factors in this studied population might provide insight to enable more tailored educational and therapeutic interventions.

Methods

Study design

A descriptive cross-sectional and correlational study was carried out in five healthcare institutions across four cities in Colombia (Barranquilla, Monteria, Cartagena, and Ríohacha) from October 2018 to July 2019.

Participants

This study assessed older individuals participating in NCD prevention and management programs. Patients were eligible if they were ⩾60 years old, able to walk independently or with the assistance of a support device (cane, crutch, or walker), and willing to provide written informed consent. Participants with any of the following conditions were excluded: hemodynamic instability, severe sequelae of cerebrovascular accident (CVA) resulting in loss of strength, aphasia, or motor alterations, advanced or unstable Parkinson's disease, severe impairment of motor skills, or speech, or severe deficits in vision and hearing. In addition, those with incomplete data were excluded from the study. The final sample was comprised of 230 individuals (Figure 1).

Study variables and instruments

Sociodemographic variables included age, sex, education, marital status, social class, health insurance, and occupation. The study employed Fried's five criteria to assess frailty in individuals aged over 60. Participants were categorized based on the number of criteria they met, classifying them as frail if they met more than three criteria, prefrail if they met one or two criteria, and nonfrail if they met none.[1] These criteria were:

Involuntary weight loss: assessed using a question from the Mini Nutritional Assessment (MNA) questionnaire[12] or by body mass index (BMI). People who reported recent weight loss or whose BMI was less than 21 kg/m^2 were classified as frail on this criterion.[13]

Grip strength: measured with a Dynatron dynamometer (Jamar ®). The best result of three trials (intervals of 15 s between each trial) with the dominant hand was taken. Values were adjusted for sex and BMI as recommended by Fried.

Slowness of gait: the subject was requested to walk 4.5 m at a normal pace, and the speed was calculated in m/s. The participant was requested to ambulate one more meter to avoid deceleration at the end. The shortest time (highest speed) out of two measurements was obtained. Speed was adjusted for sex and height.

Weakness or Exhaustion: The item from the Center for Epidemiological Studies Depression 10 (CES-D10) Scale that measures the feeling of physical fatigue in the last month was used. Participants responded to the question: Do any of the

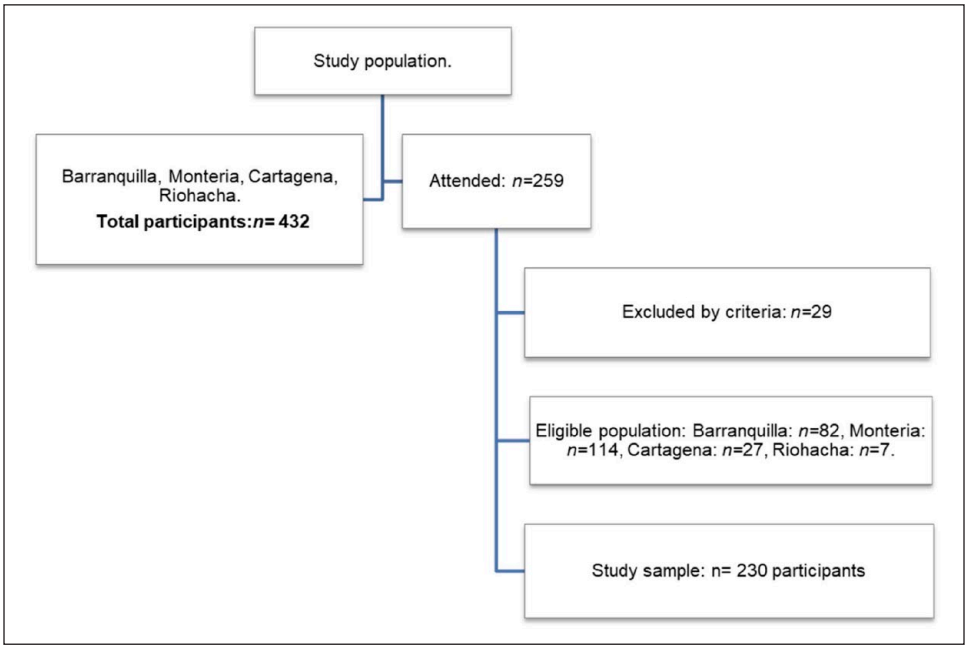

Figure 1. Study flowchart.

following statements reflect how you have felt in the last week? "I felt like everything I did was an effort" and "I didn't feel like doing anything." The response options were 0 (rarely or never; less than 1 day), 1 (some or a little of the time; 1–2 days), 2 (frequently; 3–4 days), and 3 (always or most of the time; 5–7 days). Participants who responded "2" or "3" to either of these two phrases were classified as frail on this criterion.[13]

Low physical activity: measured using the Reuben Hierarchical Physical Activity Questionnaire. Participants were classified into four categories (frequent vigorous exercise, frequent long walks, frequent short walks, or inactive) according to the type and frequency of physical activity they performed. The latter was considered frail on this criterion.[14,15]

We also explored factors that could influence frailty and functional capacity in older people. The Barthel Index, Lawton Scale, and COOP WONCA Vignette were used to measure basic ADLs, instrumental ADLs (IADLs), and social ADLS (SADLs), respectively. Furthermore, cognitive impairment was measured with the Pfeiffer Questionnaire and comorbidities were classified based on the Charlson Comorbidity Index.

The Barthel Index evaluates people's ability to perform ten basic ADLs (e.g., feeding, dressing, grooming, and sphincter control). Each activity has a score from 0 to 15 points based on the degree of dependency (total score ranging from 0 to 100 with higher scores indicating higher independence). People who needed help in some activities were considered dependent. This test has high reliability and internal consistency, with Kappa indices between 0.84 and 0.97 and Cronbach's alpha between 0.86 and 0.92.[16]

The Lawton Scale measures how well people can do eight daily tasks, such as using the phone, shopping, or cooking. Each task gets 1 point if done independently, or 0 if not. The total score ranges from 0 (fully dependent) to 8 (fully independent) for women, and from 0 to 5 for men. Participants with a score of 0 were considered dependent. This scale is reliable, with interobserver and test-retest scores of 0.99 and 0.93, respectively.[17]

The COOP/WONCA slide questionnaire inquiries about how physical and emotional health affects social activities with family, friends, neighbors, or groups in the last 4 weeks. Responses range from 1 (No, not at all) to 5 (Very much). Anyone who answered 2 or higher was considered dependent. This questionnaire is consistent and reliable, with a Cronbach's alpha of 0.77 and a Spearman correlation between 0.52 and 0.72 in the Spanish version.[18]

Pfeiffer Questionnaire: This test evaluates cognitive impairment with 10 items on orientation, memory, concentration, and calculation with every error indicating one point. Based on this, they are classified as normal (0–2 points), mild (3–4), moderate (5–7), or severe ($\geqslant$8) cognitive impairment. One point is allowed for low or high education.[19]

Charlson Comorbidity Index (CCI): consists of 19 medical conditions classified into four groups according to the weight assigned to each disease. The total score is 37 and a score $\geqslant$3 is considered comorbidity. It has acceptable interobserver reliability using a weighted kappa of 0.945.[20]

The complete tool with the aforementioned questionnaires, which have been previously validated and used in prior studies, can be accessed in the Online Supplemental Material.

Data sources/measurement

Data was collected by applying the instruments and a survey on the participants' sociodemographic and health-related variables.

Sample size

The study utilized nonprobabilistic, random convenience sampling for participant selection. No formal sample size justification was completed as we aimed to include the participants attending these programs throughout the study period. They were identified by accessing the medical records of individuals who had undergone evaluations at their respective healthcare institutions.

Statistical analysis

Univariate analyses involved measures of central tendency and frequencies. Bivariate analyses employed appropriate statistical tests based on the type and normality of the variables, such as Chi-squared for categorical variables and Student's *t*-test for continuous variables. A significance level of $p \leqslant 0.05$ was set. To evaluate the factors associated with frailty, prefrail and frail individuals were grouped into a single "frail" group and compared to nonfrail individuals. Bivariate logistic regression was used to estimate the relationship between variables; we used the odds ratios (OR) and their 95% confidence intervals (CI). Analyses were carried out with IBM SPSS Statistics Base Concurrent User program version 26 for Windows with the serial number 5726144, under the Universidad Simón Bolívar license.

Ethical considerations

This study follows the Declaration of Helsinki and the Singapore Statement on Research Integrity. This investigation is classified as "minimal risk"; according to article 11 of Resolution number 008430 of 1993 of the Republic of Colombia issued by the Ministry of Health. Approval from the Universidad Simon Bolivar's Ethics Committee was obtained (No. 00177, 16 February 2018). All participants provided written informed consent. To maintain the confidentiality of information in the database, the names and personal data of study participants were excluded.

Results

Baseline characteristics

A total of 230 subjects were included with a mean age of 71.9 ± 8.0 years. Most were women (57.8%), had a low level of education (63.5%), and were not currently employed (76.5%). Regarding functional dependency, 28.7%, 37.8%, and 37.8% of subjects were considered dependent on their ADLs, IADLs, and SADLs, respectively. Most (87%) of participants had a high CCI. Statistically significant differences were seen between the groups as outlined in Table 1.

Frailty assessment

Overall prevalence of frailty and prefrailty was 27.4% and 58.7%, respectively. Among frail patients, there was a higher proportion of women (79.4%) than men (20.6%) ($p < 0.01$). Weight loss, exhaustion, slow gait, and low physical activity criteria were also more prevalent in women than in men, while grip strength showed a similar distribution. (Table 2). Most of the participants with frailty were in the 70–79 age group (36.5%) (Table 1).

Comorbidity assessment

Each individual in the sample had at least one chronic disease, and 87.4% exhibited high comorbidity. High comorbidity was more prevalent in women (90.2%) than in men (83.5%). The most common diseases were hypertension (76.5%), prior myocardial infarction (70%), type 2 diabetes mellitus (24.3%), chronic obstructive pulmonary disease (COPD) (16.5%), chronic kidney disease (14.8%), asthma (12%), and heart failure (4.8%) (Table 3).

Analysis of key factors associated with frailty

Table 4 presents the results of the logistic regression analyses. Factors (gender, age, socioeconomic status, educational level, dependence on ADLs, cognitive impairment, and comorbidity index) were selected based on prior literature and were dichotomized to allow analyses. Being female (OR: 3.60 (95% CI: 1.62–8.03)), age $\geqslant$75 years (OR: 2.64 (95% CI: 1.03–6.71)), having low educational level (OR: 8.41 (95% CI: 3.44–20.52)), being dependent on ADLs (OR: 4.51 (95% CI: 1.32–15.36)) or IADLs (OR 5.05 (95% CI: 1.70–14.95)), and those with cognitive impairment (OR: 1.26 (95% CI: 1.16–1.37)) were significantly associated higher odds of being frail. All these associations were found to be significant at $p < 0.01$. In contrast, no association was seen between frail/prefrail and CCI (OR: 0.44 (95% CI: 0.17–1.15)).

Discussion

This study examined the prevalence of frailty and its associated factors in an older population across four Colombian cities. We identified a frequency of 27.4% and 58.7% of frailty and prefrailty, respectively, based on Fried's criteria.[1] Our study also identified key factors that are associated with higher odds of frailty including sex, age, education, socioeconomic level, and dependence on ADLs.

Other studies have reported varying frailty prevalence in patients with specific comorbidities. For instance, studies involving older individuals with CVDs have reported

Table 1. Baseline characteristics classified by frailty status.

Characteristics	Variables	Frailty (%), $n=63$	Prefrailty (%), $n=135$	No frailty (%), $n=32$	Total, $n=230$	p-Value*
Age range	60–69	19 (30.2)	61 (45.2)	21 (65.6)	101 (43.9)	0.01
	70–79	23 (36.5)	55 (40.7)	9 (28.1)	87 (37.8)	
	80+	21 (33.3)	19 (14.1)	2 (6.3)	42 (18.3)	
Sex	Female	50 (79.4)	73 (54.1)	10 (31.3)	133 (57.8)	0.01
	Male	13 (20.6)	62 (45.9)	22 (68.8)	97 (42.2)	
Marital status	With partner	51 (81)	100 (74.1)	30 (93.8)	181 (78.7)	0.04
	Without partner	12 (19)	35 (25.9)	2 (6.3)	49 (21.3)	
Education	Primary or less	53 (84.1)	86 (63.7)	7 (21.9)	146 (63.5)	0.01
	Secondary school or higher	10 (15.9)	49 (36.3)	25 (78.1)	84 (36.5)	
Employment	Employed	3 (4.8)	35 (25.9)	16 (50.0)	54 (23.5)	0.01
	Not employed	60 (95.2)	100 (74.1)	16 (50.0)	176 (76.5)	
Medical insurance	Uninsured	1 (1.6)	0 (0.0)	2 (6.3)	3 (1.3)	0.01
	With medical insurance	62 (98.4)	135 (100)	30 (93.8)	227 (98.7)	
Socioeconomic level**	1 (very low)	43 (68.3)	62 (45.9)	9 (28.2)	114 (49.5)	0.01
	2 (low)	12 (19.0)	43 (31.9)	11 (34.4)	66 (28.7)	
	3 (medium–low)	8 (12.7)	21 (15.6)	4 (12.5)	33 (14.3)	
	4 (medium)	0 (0.0)	2 (1.5)	5 (15.6)	7 (3.0)	
	5 (medium–high)	0 (0.0)	4 (3.0)	3 (9.4)	7 (3.0)	
	6 (high)	0 (0.0)	3 (2.2)	0 (0.0)	3 (1.3)	
Basic activities of daily living	Dependent	23 (36.5)	40 (29.6)	3 (9.4)	66 (28.7)	0.08
	Independent	40 (63.5)	95 (70.4)	29 (90.6)	164 (71.3)	
Instrumental activities of daily living	Dependent	38 (60.3)	45 (33.3)	4 (12.5)	87 (37.8)	0.01
	Independent	25 (39.7)	90 (66.7)	28 (87.5)	143 (62.2)	
Social activities of daily living	Dependent	5 (7.9)	78 (57.8)	4 (12.5)	87 (37.8)	0.01
	Independent	58 (92.1)	57 (42.2)	28 (87.5)	143 (62.2)	
Cognitive impairment	Impairment	36 (57.1)	42 (31.1)	0 (0.0)	78 (33.9)	0.01
	No impairment	27 (42.9)	93 (68.9)	32 (100)	152 (65.5)	
Charlson comorbidity index	$\geqslant 3$	62 (98.4)	114 (84.4)	25 (78.1)	201 (87.4)	0.01
	$\leqslant 2$	1 (1.6)	21 (15.6)	7 (21.9)	29 (12.6)	
Comorbidities	Hypertension	50 (79.4)	101 (74.8)	25 (78.1)	176 (76.5)	0.76
	Prior myocardial infarction	50 (79.4)	90 (66.7)	21 (65.6)	161 (70)	0.16
	Diabetes mellitus	24 (38.1)	28 (20.7)	4 (12.5)	56 (24.3)	0.79
	Chronic obstructive pulmonary disease	12 (19)	23 (17)	3 (9.4)	38 (16.5)	0.47
	Chronic kidney disease	21 (33.3)	12 (8.9)	1 (3.1)	34 (14.8)	0.00

*Chi-square (Pearson), statistical significance was defined by $p < 0.05$.
**Colombian socioeconomic level in https://www.dane.gov.co/files/geoestadistica/Preguntas_frecuentes_estratificacion.pdf.

a prevalence of frailty that often exceeds 60%.[21–23] In the context of CKD, frailty has been reported up to 14% among older individuals with nondialysis CKD and 42%–73% among those on dialysis.[24] Furthermore, in people with COPD, Maddocks et al. identified a prevalence of 25.6%.[25] Altogether, our data and these prior studies underscore the importance of assessing frailty in patients with chronic diseases.

Across Latin America and the Caribbean, the overall frailty prevalence is reported at 19.6%, with a range from 7% to 42.6%. This prevalence appears higher than in other developed countries, attributed to social, economic, cultural, and health-related factors.[26] For example, Chile reported a lower prevalence at 10.9%, with rates of 7.7% for men and 14.1% for women.[27] These variations may indicate differences in sociodemographic, functional, and clinical features even within a region. In Colombia, the prevalence of prefrailty and frailty varies among studies.[10,14,22] In the SABE Colombia study, the prevalence of frailty and prefrailty was 17.9% and 63.3%, respectively, in line with our results.[10] In contrast, Gomez Montes et al. had a lower frequency of frailty (12.1%) and a similar frequency of prefrailty (53%) in a study conducted in the Colombian Andes Mountains region when compared to our results from a Caribbean region.[14] These differences merit further investigation to assess if socioeconomic and geographical variables per region affect

Table 2. Frailty and its criteria by sex.

Variables	Frequency *n* (%)	Men (*n* = 97)	Women (*n* = 133)	Total (*n* = 230)	*p**
Criteria	Weight loss	21 (21.6)	35 (26.3)	56 (24.3)	0.41
	Self-reported exhaustion	13 (13.4)	30 (22.6)	43 (18.7)	0.07
	Slow walking	17 (17.5)	55 (41.4)	72 (31.3)	0.01
	Weakness (hand-grip strength)	62 (63.9)	94 (70.7)	156 (67.8)	0.27
	Low physical activity	20 (20.6)	65 (48.9)	85 (37.0)	0.01
Number of frailty components	0	22 (22.7)	10 (7.5)	32 (13.9)	0.01
	1	38 (39.2)	37 (27.8)	75 (32.6)	
	2	24 (24.7)	36 (27.1)	60 (26.1)	
	3	10 (10.3)	35 (26.3)	45 (19.6)	
	4	3 (3.1)	13 (9.8)	16 (7.0)	
	5	0 (0.0)	2 (1.5)	2 (0.9)	
Frailty	Frailty	13 (13.4)	50 (37.6)	63 (27.4)	0.01
	Prefrailty	62 (63.9)	73 (54.9)	135 (58.7)	
	No-frailty	22 (22.7)	10 (7.5)	32 (13.9)	

*Chi-square (Pearson), statistical significance was defined $p < 0.05$.

Table 3. Charlson comorbidity index associated with gender.

Variable		Sex		Total	*p**
		Female	Male		
Comorbidity	⩾3	120 (90.2)	81 (83.5)	201 (87.4)	0.12
	⩽2	13 (9.8)	16 (16.5)	29 (12.6)	
Total		133 (57.8)	97 (42.2)	230 (100)	

*Chi-square (Pearson), statistical significance was defined with $p < 0.05$.

the prevalence of frailty and prefrailty, thus a nationwide study assessing these differences in Colombia is needed.

Furthermore, studies have explored the association between sociodemographic characteristics and frailty. Studies from Brazil, Colombia, and Spain have reported that female gender, advanced age, low socioeconomic status, and lack of education were associated with frailty.[8,11,28] These findings align with our study as we identify that women, those with older age, low socioeconomic or low educational level had higher odds of frailty. This might guide healthcare providers in identifying those at higher risk of frailty and highlight the need for a multidisciplinary approach.

Our study also revealed an association between frailty and functional variables. Being dependent on ADLs has been identified as a significant risk factor for frailty, suggesting a potential correlation with the loss of muscle mass, strength, balance, and mobility. In contrast, frailty can contribute to the dependence on ADLs, resulting in a decline in the functionality and autonomy of older individuals.[29] Santamaría-Peláez et al.[30] conducted a study on 283 noninstitutionalized older individuals (12.7% were frail and 46.6% prefrail) and demonstrated a correlation between frailty and increased dependence in ADLs and IADLs as assessed by the Barthel and Lawton and Brody scales, respectively.

Menéndez-González et al.[8] reported that 33.6% of frail subjects had high CCI. In our study, we identified a concerningly high CCI, which might be explained due to our study population (patients in NCD management programs). Moreover, cognitive frailty, defined as the coexistence of physical frailty and cognitive impairment, has garnered increased attention in recent times. In a cross-sectional study conducted at a Community Health Service Center, it was reported that 20.8% of participants exhibited cognitive frailty. Those with cognitive frailty were characterized as being older, having lower income, and a higher proportion engaged in farming compared to those without cognitive frailty.[31] In our study, we found a high prevalence of cognitive impairment among prefrail (31.1%) and frail (57.1%) individuals.

The most common frailty criterion was muscle weakness in both female and male participants. Slow gait and low physical activity were significantly associated with sex ($p < 0.01$), with a higher prevalence in women. Based on the total number of frailty components, women had higher percentages of individuals with 2–5 frailty criteria. These findings are consistent with the results reported by Jürschik Giménez et al.[13]; however, their study encompassed both healthy individuals and those with self-reported diseases.

This study identified that individuals aged over 75 had a threefold increase in odds of being frail, which was consistent

Table 4. Analysis of the risk of frailty according to sociodemographic and health characteristics.

Characteristics	Variables	Prefrailty/Frailty	No frailty	*p*-Value*	OR (CI 95%)
Sex	Female	123 (62.1)	10 (31.3)	0.01	3.60 (1.62–8.03)
	Male	75 (37.9)	22 (68.8)		
Age	⩾75	75 (37.9)	6(18.8)	0.03	2.64 (1.03–6.71)
	<75	123 (62.1)	26 (81.3)		
Marital status	Without partner	47 (23.7)	2 (6.3)	0.02	4.66 (1.07–20.27)
	With partner	151 (76.3)	30 (93.8)		
Education	Primary or less	139 (70.2)	7 (21.9)	0.01	8.41 (3.44–20.52)
	Secondary school or higher	59(29.8)	25(78.1)		
Socioeconomic level	Low	160 (80.8)	20 (62.5)	0.02	2.52 (1.13–5.61)
	Medium/High	38 (19.2)	12 (37.5)		
Basic activities of daily living	Dependent	63 (31.8)	3 (9.4)	0.01	4.51(1.32–15.36)
	Independent	135 (68.2)	29 (90.6)		
Instrumental activities of daily living	Dependent	83 (41.9)	4 (12.5)	0.01	5.05 (1.70–14.95)
	Independent	115 (58.1)	28 (87.5)		
Social activities of daily living	Dependent	83 (41.9)	4 (12.5)	0.01	5.05 (1.70–14.95)
	Independent	115 (58.1)	28 (87.5)		
Cognitive deterioration	Impairment	78 (39.4)	—	0.01	1.26 (1.16–1.37)
	No impaired	120 (60.6)	32(100)		
Charlson comorbidity index	⩾3	176 (87.6)	25 (12.4)	0.08	0.44 (0.17–1.15)
	⩽2	22 (75.9)	7 (24.1)		

*Chi-square (Pearson), statistical significance was defined with $p < 0.05$.

with prior studies. Pinheiro et al.[32] observed a significant association between age and frailty ($p = 0.0001$), and Lyu et al.[33] reported that the prevalence of frailty increased with aging (OR: 1.12; 95% CI: 1.04–1.62). These findings suggest that the natural decline in various systems during aging, coupled with existing health conditions, contributes to an increased risk of frailty.

Importantly, Ng et al.[34] developed the frailty risk index (FRI) to assess the risk of this syndrome in the community. The FRI predicted very key outcomes such as subsequent hospitalization and combined adverse health outcomes. These results underscore the importance of identifying and preventing frailty in older individuals. Several studies support the idea that frailty can be reversed with proper interventions, particularly in prefrail cases and early limitations in ADLs.[2,35] Multi-component physical exercise (incorporating strength, endurance, balance, and flexibility exercises) has proven to be an effective intervention for frailty. Regular and sustained engagement in such exercises improves physical performance, functional capacity, and independence in ADL.[35] Losa-Reina et al.[36] demonstrated positive outcomes in frail patients through their trial, revealing a reduction in the number of criteria among those with 4 or 5 frailty criteria and an improvement in physical performance.

Limitations

This study is not without limitations. First, our sample was self-selected and based on convenience sampling, without sample size justification, limiting the power and external validity of our results as well as introducing selection bias to our study. Second, the observed variables demonstrate an association rather than a causal relationship. For instance, the link between frailty and chronic disease is correlational rather than indicative of a cause-and-effect association. Third, the results may be influenced by uncontrolled confounding variables or biases. For instance, the characteristics of older adults from rural areas individuals may not be representative of the broader population, as they could possess distinct sociodemographic, cultural, economic, or health factors. Generalizing the results to other populations or contexts may be challenging due to significant variations. The heterogeneous nature of aging complicates the process of applying findings universally. For instance, conclusions drawn from a study conducted in a specific Colombian region may not apply to other regions or countries without accounting for their unique characteristics.

Conclusions

This study identified a significant prevalence of prefrailty and frailty among older adults with chronic diseases in Colombia. Key factors associated with frailty include older age, sex, cognitive impairment, and sociodemographic variables. These findings contribute to recognizing predictors of frailty and highlight the importance of designing effective prevention and therapeutic strategies for this population. Future studies are still needed to clarify further predictors of frailty given the variability of this syndrome. Furthermore, investigations assessing the effect of potential interventions aiming at preventing or reversing this syndrome are welcomed. Additionally, standardizing the measurement methods and

definitions is key to enhancing the accuracy and comparability of frailty estimates.

Author contributions

MVQ-C: Conceptualization; Methodology; Formal analysis; Data Curation; writing—original draft preparation; Investigation; Project administration. MM-M: Conceptualization; Methodology; Formal analysis; Data Curation, writing—original draft preparation; Investigation; Project administration. MU-J: Methodology; writing—original draft preparation; writing—review and editing. YPP: Investigation; Project administration. CIQ-DG: Investigation; Project administration. WB: Investigation; Project administration. LDA-Q: Investigation; Project administration. KC: Investigation; Project administration. MU-T: Methodology; Formal analysis; writing—original draft preparation; writing—review and editing.

Data availability statement

Data is available upon reasonable request to the corresponding author. They are not publicly available as sub-analyses are currently ongoing.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study belongs to the research: "Frailty and functional ability in older adults with chronic disease" supported by the Universidad Simón Bolívar.

Ethics institutional review board statement

This study follows the ethical considerations of the Declaration of Helsinki and the Singapore Declaration. This investigation is classified as "minimal risk" according to article 11 of Resolution number 008430 of 1993 of the Republic of Colombia issued by the Ministry of Health. Approval from the Universidad Simon Bolivar's Ethics Committee was obtained (No. 00177, 16 February 2018). All participants provided written informed consent. To maintain the confidentiality of information in the database, the names and personal data of study participants were excluded.

Informed consent

Written informed consent was obtained from all subjects before the study.

Trial registration

Not applicable.

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Supplemental material

Supplemental material for this article is available online.

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