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Similarities Among Factors Associated With Components of Frailty in Elderly: SABE Study

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Abstract

Objective: To analyze similarities among factors associated with the components of frailty in elderly. **Method:** We studied 1,413 elderly from the second wave of the SABE Study in 2006. Each of the five components of the frailty phenotype was considered a dependent variable in the hierarchical logistic regression models. **Results:** In both genders, age, schooling, sedentary lifestyle, and screening positive for depression were associated similarly with more than one component of frailty. Other similarities were also observed with stroke and screening positive for cognitive decline in men, and number of diseases and gait speed in women. The most similar associations happened between weakness and slowness; weakness, slowness, and LPAL; or weakness, slowness, and exhaustion. **Discussion:** Encouraging physical activity, screening for and treating depression and treating both diseases of the central nervous system and chronic diseases must be the focus of strategies to avoid, delay, or even remedy frailty.

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elderly, components, frailty, SABE Study

Introduction

Frailty has been defined as a biologic syndrome characterized by a decrease in reserves and lower resistance to stressors. This decrease results from cumulative decline across multiple physiologic systems, making the individual vulnerable to adverse outcomes (Fried et al., 2001; Hamerman, 1999). The likelihood of frailty appears to increase nonlinearly in relation to the number of physiologically abnormal systems; the result is an impaired capacity of the organism to maintain homeostasis. Thus, having more compromised systems is more predictive of frailty than the isolated impairment of any single system (Fried et al., 2009).

The unification of factors related to this syndrome has allowed clinicians/researches to determine the frailty phenotype through five components: unintentional weight loss, weakness, self-reported exhaustion, slow gait speed (slowness), and a low physical activity level (LPAL). Based on this concept, elderly individuals with none of these components are robust; those with one or two are considered pre-frail and those with three or more are classified as frail (Fried et al., 2001).

Studies addressing the mechanisms involved in this syndrome have sought to analyze factors associated with pre-frailty or frailty based on their constructs. However, if a set of compromised systems increases the risk of frailty by triggering the emergence of the central components of this syndrome, it is necessary to determine the factors simultaneously associated with more than one of the five components that make up the frailty phenotype (Walston et al., 2006). The identification of such factors will allow clinicians/researches to focus on strategies aimed at preventing, delaying or, if possible, remedying this situation.

Thus, the aim of the present study was to analyze similarities between factors associated with the components of frailty in the elderly in the city of São Paulo, Brazil.

Method

The present study employed data from the SABE (*Saúde, Bem-Estar e Envelhecimento/*Health, Wellbeing, and Aging) Study that began in 2000. In 2006, the second wave of the study was carried out, involving interviews of 1,413 elderly individuals representative of the urban population aged 60 years and older in the city of São Paulo. The present analysis involves all individuals evaluated in 2006 (874 women and 540 men). All participants signed a statement of informed consent, and the SABE Study received approval from the Human Research Ethics Committee of the Public Health School of the University of São Paulo.

The components of the frailty phenotype were identified using the model proposed by Fried et al. (2001) as follows. Unintentional weight loss was considered the loss of three or more kilograms in the previous 3 months not related to dieting. Exhaustion was analyzed using two questions based on the Center for Epidemiological Studies–Depression (CES-D) Scale: (a) How often in the past week have you felt that everything you did required an effort? and (b) How often in the past week have you not been able to "get going"? Individuals who reported having these feelings for more than 3 days were considered frail with regard to the exhaustion criterion (Fried et al., 2001).

Grip strength was measured using a dynamometer. Weight and height were measured with the participant barefoot and wearing the least amount of clothing possible. The body mass index (BMI) was then calculated and distributed among quartiles for each gender. In each quartile, the weakest 20% of individuals in grip strength were classified as having weakness (Fried et al., 2001; Table 1).

Gait speed was determined by the walk test of the Short Physical Performance Battery Assessing Lower Extremity Function (Guralnik et al., 1994). The slowest 20% of individuals were classified as having reduced gait speed according to the mean height (Table 1).

The level of physical activity was assessed using the Brazilian version of the International Physical Activity Questionnaire (IPAQ; Guedes, Lopes, & Guedes, 2005). The calculation of caloric expenditure involved the metabolic equivalent (MET—metabolic cost of the physical activity in question), the activities performed by the participant, the number of days per week each activity was performed, time spent performing the activity, and the body weight of the individual (Craig et al., 2003). Women and men with a caloric expenditure of less than 478.15 kcal and 390.5 kcal (smallest quintile), respectively, were classified as having LPAL.

Associations were tested between each frailty component and the following independent variables divided into four hierarchical blocks:

- Socioeconomic aspects: age, marital status (with or without conjugal life), perception of sufficient income (yes/no), and schooling (in years).
- Behavioral aspects: Smoking was classified in three categories—nonsmoker, ex-smoker, and smoker. Alcohol intake was measured using

Table 1. Characteristics of 1,413 Elderly Residents in São Paulo, Brazil; 2006 SABE Study.

	Men n = 540	Women n = 873
Socioeconomic aspects		
Age (years)	68.9 ± 0.6*	70.1 ± 0.2*
Marital status (with conjugal life)	78.7%*	42.9%*
Insufficient income (yes)	56.2%	54.3%
Schooling (years)	4.9 ± 0.3*	4.1 ± 0.1*
Behavioral aspects		
Smoking		
Never smoked	28.6%*	67.9%*
Ex-smoker	53.9%*	20.5%*
Current smoker	17.5%*	11.6%*
Risk of alcoholism (yes)	14.8%*	1.4%*
Sedentary (yes)	20.1%	20.0%
Health status		
Arterial hypertension (yes)	58.1%*	65.7%*
Diabetes (yes)	19.7%	22.1%
Lung disease (yes)	13.6%	11.0%
Heart disease (yes)	24.2%	20.9%
Stroke (yes)	10.8%*	6.7%*
Joint disease (yes)	19.5%*	42.2%*
Chronic pain (yes)	28.2%*	38.9%*
Medications (yes)	85.1%*	94.6%*
None	14.9%*	5.4%*
One to three medications	49.7%*	39.8%*
Four or more medications	35.5%*	54.8%*
Difficulty swallowing (yes)	62.3%*	68.8%*
Difficulty eating (yes)	26%	23.4%
MMSE (≤18 points)	9.5%	10.3%
GDS (≥6 points)	9.3%*	17.6%*
Number of diseases	1.5 ± 0.06*	2.0 ± 0.05*
None	22.5%*	13.1%*
One or two	59.2%*	54.4%*
Three or more	18.3%*	32.5%*
Anthropometry and physical performance		
Grip strength (kg)	33.02 ± 0.5*	19.2 ± 0.2*
Gait speed (seconds)	4.03 ± 0.1*	4.5 ± 0.1*

Note. Proportion; mean ± standard deviation. SABE = *Saúde, Bem-Estar e Envelhecimento*/Health, Wellbeing, and Aging; MMSE = Mini Mental State Exam; GDS = Geriatric Depression Scale.
*$p \leq .05$.

the Short Michigan Alcoholism Screening Test–Geriatric Version (elderly individuals with two or more points were considered at risk of exhibiting alcohol problems; Blow et al., 1992; Blow, Gillespie, Barry, Mudd, & Hill, 1998). Based on the IPAQ, participants were considered sedentary with a caloric expenditure of less than 478.15 kcal and 390.5 kcal for women and men, respectively.

- Health status: self-reported arterial hypertension, diabetes, heart disease, stroke, joint disease, chronic pain, use of medications (yes/no) and difficulties swallowing and eating due to oral problems. A quantitative variable was created to represent the number of diseases for each individual. The Mini Mental State Exam (MMSE) was used to assess cognitive status (Folstein, Folstein, & Mchugh, 1975), with a cutoff point of ≤18 used to identify cognitive decline (Fried et al., 2001). The Geriatric Depression Scale (GDS) was used to determine the presence of depressive symptoms (Sheikh & Yesavage, 1986), indicated with a cutoff point of ≥6 (Almeida & Almeida, 1999).
- Anthropometric measures and physical performance: grip strength and gait velocity. Although these variables, when respectively reported in quartiles and quintiles, represent components of the frailty phenotype, they were used as continuous independent variables in the regression models of other components, because Xue, Bandeen-Roche, Varadhan, Zhou, and Fried (2008) found that both can be early indicators of the frailty process and may interfere with the appearance of other components.

All independent variables represent a broad spectrum of factors involved in cycle of frailty (Fried et al., 2001). Differences between genders were analyzed using the Rao and Scott Wald test and chi-square test with the Rao–Scott correction (Rao & Scott, 1984, 1987). Both tests considered the design weights.

Each component of frailty was considered a dependent variable in the univariate logistic regression models. The number of elderly individuals in each model was not constant, as a lack of information in one component rendered the use of information from other components unviable in their respective regression models. Following the univariate analysis, hierarchical multiple analyses were performed. Hierarchical models are adopted in epidemiology on behalf of the large number of factors involved in the genesis of diseases or syndromes, and are therefore a good method by which to study frailty. In addition, they allow us to analyze associations by levels. The choice of variables must follow a theoretical model that can explain the process and the possible pathways involved in disease development (Olinto, 1998; Witte, Greenland, Haile, & Bird, 1994). In the present study, the factors analyzed were grouped into the aforementioned blocks and arranged based on the proximity with which such factors are believed to influence the components of frailty (Figure 1). The upper level includes socioeconomic variables as distal factors; the intermediate level includes behavioral variables such as smoking, alcohol intake, and physical activity; the lower level includes variables that represent the state of health and anthropometric and physical performance, which according to the literature act more directly on frailty than do behavioral variables. The first model analyzes the relationship between frailty components and distal factors. The identification of a statistically significant association ($p < .05$) between a particular factor and a frailty component demonstrated an independent effect regarding the factor in question. The insertion of the intermediate variables allowed the identification of a statistically significant association ($p < .05$) between a particular intermediate level factor and a frailty component (after controlling for potential factors in the same level and hierarchically higher blocks). The same strategy was adopted later for the insertion of distal factors into the model (health status, anthropometry, and physical performance). All analyses also took into consideration the sample weights for estimates with weighted populations. The Stata 11 program was employed for the statistical analysis.

Results

Analyses by gender showed that women were older and had more arterial hypertension, depression, and joint disease than men. Men had more years of schooling and the majority was married; they smoked more, had a higher risk of alcoholism and greater prevalence of stroke than women. However, men had higher average handgrip strength and gait speed than women (Table 1).

The prevalence of frailty components did not differ statistically between genders. Weakness was the most prevalent component of frailty, followed by LPAL, slowness, exhaustion, and unintentional weight loss (Table 2).

In the hierarchical model, in both genders, age was positively associated with weakness, slowness, and LPAL, while schooling was negatively associated with weakness and slowness. A negative association was found between schooling and exhaustion in men (Tables 3 and 4).

Among behavioral factors, a sedentary lifestyle was associated with exhaustion, weakness, and slowness in men and women; In addition, smoking was associated with exhaustion in women only.

Regarding health status, screening positive for depression was associated with exhaustion in men and women, with weakness and LPAL in women and with unintentional weight loss in men. A greater number of diseases were associated with LPAL in both genders and with unintentional weight loss in

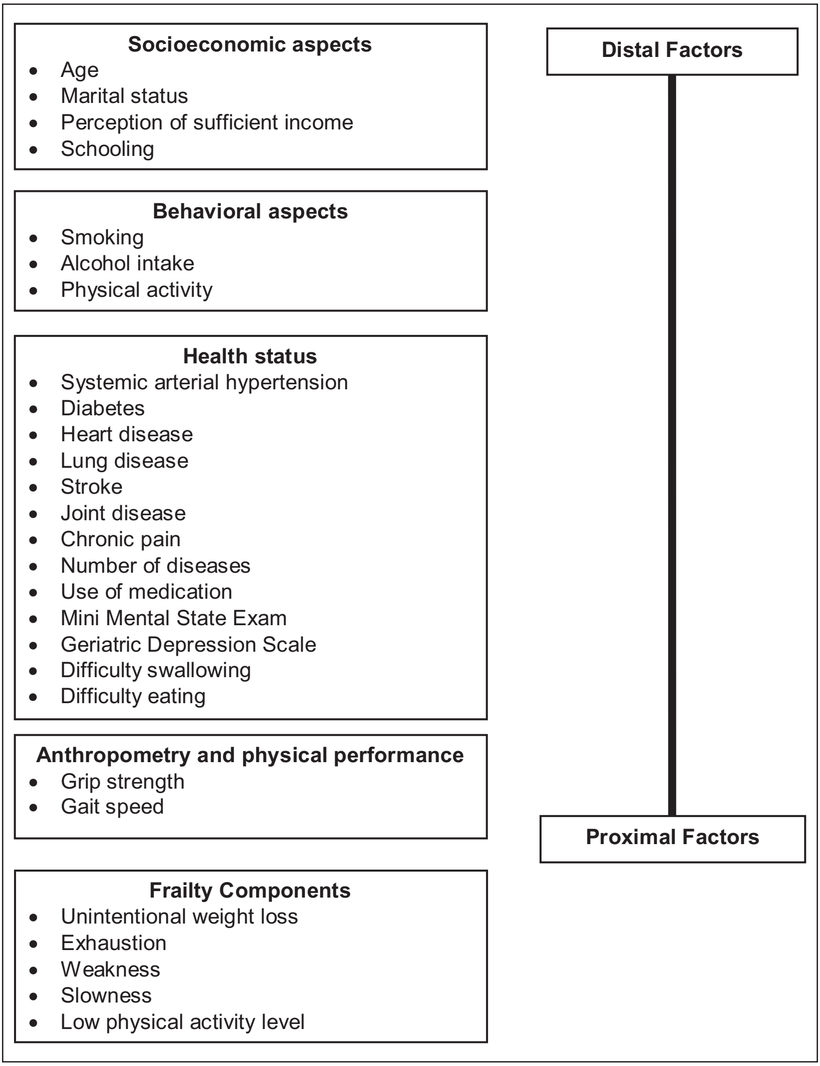

Figure 1. Theoretical model for investigation of factors associated with components of frailty in the elderly, structured into hierarchical blocks of variables.

women. In men and women, stroke was associated with slowness; in men, it was also associated with weakness and LPAL. Joint disease was associated with slowness in women and with exhaustion in men.

Table 2. Percent of Individuals for Each Frail Component, by Gender, Among Elderly in Brazil; 2006 SABE Study.

Component	Women (%)	Men (%)
Unintentional weight loss	8.4	6.8
≥3 kg in previous 3 months not due to dieting		
Exhaustion	15	10.8
Self-report positive answer from either of two questions on CES-D Scale		
Weakness	25.8	25.1
Lowest 20% in grip strength (adjusted by gender and BMI)		
Men		
Strength ≤ 21 kg for BMI ≤ 23.12		
Strength ≤ 25.5 kg for BMI 23.12-25.5		
Strength ≤ 30 kg for BMI 25.6-28.08		
Strength ≤ 27 kg for BMI > 28.08		
Women		
Strength ≤ 14 kg for BMI ≤ 23.8		
Strength ≤ 15 kg for BMI 23.8-27.05		
Strength ≤ 15 kg for BMI 27.06-30.83		
Strength ≤ 15 kg for BMI > 30.83		
Slowness	18.4	14.9
Slowest 20% of walking test of the Short Physical Performance		
Battery adjusted by gender and height (m)		
Men		
>5 s for height ≤ 1.66 m		
>5 s for height > 1.66 m		
Women		
>6 s for height ≤ 1.53 m		
>5 s for height > 1.53 m		
Low physical activity level	20	20.1
Lowest 20% of caloric expenditure by gender		
Men 390.5 kcal		
Women 478.15 kcal		

Note. SABE = *Saúde, Bem-Estar e Envelhecimento*/Health, Wellbeing, and Aging; CES-D = Center for Epidemiological Studies–Depression; BMI = body mass index.

Lung disease was associated with exhaustion and reduced gait speed was associated with LPAL, while screening positive for cognitive decline was

Table 3. Final Hierarchical Multiple Logistic Regression Models for Five Components of Frailty in Elderly Men in São Paulo, Brazil; 2006 SABE Study.

	Weight loss (*n* = 447)	Exhaustion (*n* = 430)	Weakness (*n* = 440)	Slowness (*n* = 487)	LPAL (*n* = 451)
	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)
Model 1—Socioeconomic aspects					
Age (years)	1.01 [0.97, 1.05]	1.03 [0.99, 1.07]	1.09 [1.05, 1.12]*	1.09 [1.06, 1.12]*	1.06 [1.04, 1.09]*
Schooling (years)	0.91 [0.83, 1.01]	0.92 [0.86, 0.99]*	0.92 [0.85, 0.99]*	0.88 [0.82, 0.95]*	
Model 2—Behavioral aspects					
Smoking					
Ex-smoker	1.28 [0.39, 4.22]				
Current smoker	3.29 [0.91, 11.9]				
Risk of alcoholism					0.55 [0.24, 1.29]
Sedentary		2.16 [1.09, 4.28]*	3.13 [1.75, 5.62]*	2.87 [1.64, 5.03]*	
Model 3—Health status					
Arterial hypertension				1.98 [0.90, 4.31]	
Heart disease			2.07 [0.96, 4.46]		
Lung disease		4.02 [1.26, 12.80]*			
Stroke			3.89 [1.96, 7.72]*	3.05 [1.21, 7.70]*	2.40 [1.22, 4.73]*
Joint disease		3.05 [1.28, 7.30]*			
MMSE (≤18 points)			4.20 [1.66, 10.61]*	2.55 [1.01, 6.44]*	
GDS (≥6 points)	3.70 [1.41, 9.73]*	4.27 [1.71, 10.70]*			
Number of diseases	1.17 [0.85, 1.62]	0.88 [0.56, 1.40]	0.97 [0.62, 1.53]	0.99 [0.70, 1.39]	1.36 [1.11, 1.66]*
Difficulty swallowing			1.28 [0.60, 2.73]	1.30 [0.50, 3.34]	
Model 4—Anthropometry and physical performance					
Grip strength (kg)	0.97 [0.90, 1.04]	0.99 [0.94, 1.06]		0.95 [0.91, 0.99]*	
Gait speed (seconds)			1.06 [0.86, 1.31]		1.17 [1.03, 1.32]*

Note. Gray highlighted areas indicate the similarities between the analyzed factors and components of frailty. SABE = *Saúde, Bem-Estar e Envelhecimento*/Health, Wellbeing, and Aging; LPAL = low physical activity level; MMSE = Mini Mental State Exam; GDS = Geriatric Depression Scale; CI = confidence interval; OR = odds ratio.
*$p \leq .05$.

Table 4. Final Hierarchical Multiple Logistic Regression Models for Five Components of Frailty in Elderly Women in São Paulo, Brazil; 2006 SABE Study.

	Weight loss (*n* = 799)	Exhaustion (*n* = 704)	Weakness (*n* = 665)	Slowness (*n* = 699)	LPAL (*n* = 664)
	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)
Model 1—Socioeconomic aspects					
Age	1.02 [0.99, 1.05]	1.01 [0.98, 1.03]	1.08 [1.06, 1.10]*	1.12 [1.09, 1.15]*	1.12 [1.09, 1.15]*
Schooling (years)		0.92 [0.85, 1.00]	0.92 [0.87, 0.98]*	0.94 [0.88, 0.99]*	
Marital status (without conjugal life)				1.11 [0.69, 1.80]	
Model 2—Behavioral aspects					
Smoking					
Ex-smoker		1.02 [0.57, 1.82]			
Current smoker		1.97 [1.02, 3.79]*			
Risk of alcoholism					0.40 [0.05, 3.16]
Sedentary	1.15 [0.57, 2.32]	1.91 [1.14, 3.20]*	2.03 [1.36, 3.03]*	4.18 [2.67, 6.53]*	
Model 3—Health status					
Heart disease		1.50 [0.74, 3.02]			
Stroke				4.93 [1.79, 13.57]*	1.16 [0.48, 2.78]
Joint disease				1.90 [1.06, 3.40]*	
Chronic pain		4.06 [2.30, 7.16]*			
MMSE (≤18 points)			1.50 [0.56, 4.05]	1.00 [0.35, 2.84]	0.55 [0.25, 1.24]
GDS (≥6 points)		5.41 [3.00, 9.75]*	1.88 [1.15, 3.08]*	1.22 [0.67, 2.25]	2.15 [1.26, 3.68]*
Number of diseases	1.26 [1.04, 1.53]*	1.19 [0.91, 1.54]	1.08 [0.92, 1.27]	1.05 [0.83, 1.31]	1.23 [1.04, 1.45]*
Difficulty swallowing				1.42 [0.54, 3.77]	0.67 [0.34, 1.32]
Polypharmacy					
One to three medications				3.90 [0.79, 19.28]	
Four or more medications				5.63 [1.13, 28.01]*	
Model 4—Anthropometry and physical performance					
Grip strength (kg)	0.94 [0.89, 1.00]	0.97 [0.93, 1.03]		0.95 [0.90, 1.01]	0.98 [0.94, 1.03]
Gait speed (seconds)			1.16 [1.04, 1.30]*		1.17 [1.02, 1.35]*

Note. Gray highlighted areas indicate the similarities between the analyzed factors and components of frailty. SABE = *Saúde, Bem-Estar e Envelhecimento*/Health, Wellbeing, and Aging; LPAL = low physical activity level; MMSE = Mini Mental State Exam; GDS = Geriatric Depression Scale; CI = confidence interval; OR = odds ratio.
*$p \leq .05$.

associated with weakness and slowness in men, and reduced gait speed was associated with weakness in women and with slowness in men.

Discussion

The present study showed in both genders that age, schooling, sedentary lifestyle, and screening positive for depression were associated similarly with more than one component of frailty in Brazilian elderly. This association was also observed with stroke and screening positive for cognitive decline in men and with the number of diseases and gait speed in women. These associations were more similar between the following components of frailty: weakness and slowness (MMSE ≤ 18 points in men and schooling in women); weakness, slowness, and LPAL (age in both genders and stroke in men) or weakness, slowness, and exhaustion (schooling in men and sedentary lifestyle in both genders).

Age was associated with weakness, slowness, and LPAL, but not with exhaustion or unintentional weight loss in both genders. These findings suggest that advanced age is not homogeneously associated with all components of the frailty cycle and is not *per se* synonymous with vulnerability to adverse outcomes (Fried et al., 2009).

Education showed a negative association with exhaustion, weakness, and slowness in men and with weakness and slowness in women. Education is a mediator which allows access to and use of services and health insurance, influences the adoption of healthy behaviors, relationships, and social support, management of situations of acute and chronic stress, the psychological dispositions, social roles, and productive activities. Moreover, education affects people's exposure to physical, chemical, biologic, and environmental hazards—from infectious diseases to physical and chemical compounds in the workplace and in the home—and to social environmental hazards such as lack of security at work and home (House, Lantz, & Herd, 2005). These factors in turn affect a wide range of health outcomes directly or via psychoneuroendocrine, inflammatory and immunological pathways, now known as important mediators in the development of sarcopenia whose manifestations are the reduction of strength, reduced gait speed, and reported exhaustion (Fried et al., 2009).

Sarcopenia, which is at the core of frailty, is the product of age-associated changes in neurons and muscles and homeostatic alterations aggravated by chronic diseases that make muscles less efficient in generating force and makes them tire more easily (Lexell, Taylor, & Sjostrom, 1988). The greater level of fatigue is due to reduced blood flow to the muscles while at rest and during certain types of contraction. Moreover, neuronal changes in the central nervous system lead to changes in the levels and activity of neurotransmitters, which, together with the inadequate distribution of oxygen to the brain, lead to a reduction in motor units and the ability to maintain muscle activation (Meeusen, Watson, Hasegawa, Roelands, & Piacentini, 2006). Besides these central alterations, peripheral alterations, which occur due to changes in the neuromuscular junction and muscle tissue, also culminate in fatigue, weakness, and slowness (Meeusen et al., 2006; Nybo & Rasmussen, 2007; Schwendner, Mikesky, Holt, Peacock, & Burr, 1997).

Thus, a sedentary lifestyle, with its pro-inflammatory effect and increase in insulin resistance, can exacerbate these neuromuscular disorders, further impairing the function of this system (Gauchard, Gangloff, Jeandel, & Perrin, 2003). Sedentary elderly individuals have a greater likelihood of developing frailty than those engaged in exercise, regardless of demographic conditions and health status (Peterson et al., 2009). In the present analysis, sedentary lifestyle was associated with only three components of frailty: exhaustion, weakness, and slowness. This association reinforces the idea that interventions aimed at specific components of frailty, using muscle strength/endurance and balance exercises, could effectively slow the development of neuromuscular disorders such as sarcopenia that can culminate in the appearance of components of frailty (Walston et al., 2006).

Some evidence suggests an association of progression of depressive symptoms and anxiety with the onset and progression of frailty (Ní Mhaoláin et al., 2012). The present study showed that depression was associated with exhaustion in both genders; LPAL and weakness in women; and unintentional weight loss in men. Instruments such as the CES-D Scale and GDS have questions for somatic symptoms (fatigue, anorexia, and weight loss) and cognitive and affective symptoms (Dowrick, Peveler, & Lloyd, 2005), which might raise suspicions of collinearity in the associations between depression and exhaustion and unintentional weight loss components. To check collinearity, we estimated the variance inflation factor (VIF) after the final model. In an exhaustion model, VIF was 3.63 for depression in women and 1.20 for depression in men. In an unintentional weight loss model, VIF was 1.17 for depression in men. All results were less than 5.3, excluding the possibility of collinearity (Hair, Anderson, Tatham, & Blackman, 1995) and confirming that our results found an independent association between depressive symptoms, exhaustion, and weight loss.

In terms of the association with LPAL, depressive symptoms have been found to contribute to a reduction in physical activity (Hawkley, Thisted, & Cacioppo, 2009). However, changes in motor behavior, such as weakness associated with depression, could contribute to the low level of physical activity. Santos, Fernandes, Reis, Coqueiro, and Rocha (2012) found a negative correlation between the GDS score and grip strength, as the prevalence rate of reduced grip strength was 58% higher among elderly individuals with screening positive for depression than among those who were not depressed. Moreover, impaired motor performance in elderly individuals with depression may be mediated by disorders in the connectivity between the cerebellum and the cerebral cortex in different neuron networks (Alalade, Denny, Potter, Steffens, & Wang, 2011) as well as deficiencies in neurotransmitters, such as dopamine (Lexell et al., 1988).

Stroke and screening positive for cognitive decline were associated with components of frailty, principally in men. Stroke was more prevalent in men and may explain this clearer effect. However, besides the prevalence of screening positive for cognitive decline was not statistically different among genders, it seems to affect men more. These diseases alter directly the functioning of the neuromuscular system, further hindering the capacity of the muscle to generate strength and endurance. These factors affect gait and balance, reduce psychomotor activity, and lead to slowness in activities involving dual tasks (cognitive and physical) as well as motor control, contributing to the emergence of components such as weakness, slowness, and LPAL (Walston et al., 2006).

There is evidence that the likelihood of frailty increases nonlinearly in relationship to the number of abnormal physiological systems, and the number of abnormal systems is more predictive than the individual abnormal system. The accumulation of abnormal physiological systems would be exacerbated in the presence of disease, further impairing the ability of the stress response mechanisms to maintain homeostasis (Fried et al., 2009). However, the number of chronic diseases was associated only with LPAL in both genders and with unintentional weight loss in women. In the analysis of factors associated with each component of frailty, certain diseases may have had more influence of components of frailty than did the number of diseases in Fried's phenotype. Another important point to highlight is that the average number of diseases in this population is low, especially in men.

Gait speed showed a positive association with LPAL in both genders and also with weakness in women. Moreover, grip strength had a negative association with slowness only in men. Perhaps the reductions in grip strength, gait speed, and energy expenditure may be interconnected and may indicate an early sign of frailty. Previous research has already demonstrated that weakness is the first manifestation of the components of frailty in women, followed by LPAL and slowness. Moreover, the incidence of weakness, slowness, and LPAL preceded the incidence of exhaustion and weight loss in 76% of women who were non-frail at baseline. These findings demonstrate a partial hierarchy in the onset of frailty syndrome at the population level. Thus, muscle weakness may serve as a warning sign of increased vulnerability to the early development of frailty, whereas weight loss and exhaustion may identify the risk of a rapid progression from frailty to adverse outcomes in women (Xue et al., 2008).

This study has limitations that should be addressed. The data on chronic diseases originated from self-reports. While this may be a source of bias, epidemiological studies have demonstrated that self-reported data offer good validity and are consistent with medical diagnoses and the results of physical tests (Zunzunegui, Alvarado, Béland, & Vissandjee, 2009). Another important limitation is the fact that the cross-sectional design does not allow determining whether factors precede or follow the presence of the components of frailty.

In conclusion, there are similarities in the factors associated with the components of frailty. These similarities were greater between weakness and slowness, weakness, slowness, and LPAL and weakness, slowness, and exhaustion, showing that the practice of physical activity, the screening/control of depression, diseases that affect the central nervous system, and chronic diseases must be the focus of strategies aimed at avoiding, delaying, or even remedying frailty syndrome. However, other studies should examine the similarities in the determinants of incidence of the components of frailty in elderly people in longitudinal studies.

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