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Relationship of falls among the elderly and frailty components*

Relação de quedas em idosos e os componentes de fragilidade

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ABSTRACT: ***Objective:*** To evaluate whether the occurrence of falls in the year preceding the interview is associated with frailty components after a four-year period. ***Methods:*** Data were obtained from the second round of the Health, Well-being and Aging SABE Study, conducted in 2006, when 1,413 elderly people were interviewed. Individuals considered weak according to the Fried model were excluded, resulting in 1,207 elderly at the study entry. The explanatory variable was taken as the falls in the year prior to the 2006 survey. In 2010, the survivors were evaluated for the five frailty components. The statistical test with correction for the sample project (Rao-Scott) was applied to assess the association between frailty and falls at the beginning of the study. ***Results:*** Of the 1,413 individuals in the 2006 sample, 1,397 registered falls in the year before the interview and evaluation of fragility. The fragility of components for risk factors for the occurrence of falls were: (1)reduced grip strength (no falls: 21.8%; falls: 31.5%; relative risk – RR = 1.44; and p = 0.003); and (2) exhaustion (no falls: 7.6%; falls:14.7%; RR = 1.93; and p = 0.003). ***Conclusion:*** This finding suggests longitudinal studies in order to clarify the causality of falls in the elderly, considering the aspects of temporality between exposure and the event.

Keywords:Accidental falls. Frail, elderly. Elderly. Epidemiology. Risk factors. Public health.

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**in memoriam*.

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RESUMO: ***Objetivo:*** Avaliar se a ocorrência de quedas no ano anterior à entrevista está associada aos componentes de fragilidade após um período de quatro anos. ***Métodos:*** Os dados foram obtidos a partir da segunda rodada do Estudo Saúde, bem-estar e envelhecimento (SABE), realizado em 2006, quando 1.413 idosos foram entrevistados. Os indivíduos considerados frágeis, de acordo com o modelo de Fried, foram excluídos, resultando em 1.207 idosos no início do estudo. A variável explicativa foi tomada como sendo as quedas ocorridas no ano anterior à pesquisa de 2006. Em 2010, os sobreviventes foram avaliados para os cinco componentes de fragilidade. O teste estatístico com correção para o projeto de amostra (Rao-Scott) foi aplicado para avaliar a associação entre fragilidade e as quedas no início do estudo. ***Resultados:*** Dos 1.413 indivíduos na amostra de 2006, 1.397 registraram quedas no ano anterior à entrevista e avaliação da fragilidade. Os componentes de fragilidade para fatores de risco para ocorrência de quedas foram: (1) redução da força de preensão (sem quedas = 21,8%; quedas = 31,5%; razão de risco – RR = 1,44; e p = 0,003); e (2) exaustão (sem quedas = 7,6%; quedas = 14,7%; RR = 1,93; e p = 0,003). ***Conclusão:*** Esse achado sugere a realização de estudos longitudinais a fim de precisar a causalidade das quedas em idosos tendo em vista os aspectos da temporalidade entre a exposição e o evento.

Palavras-chave: Acidentes por quedas. Idoso fragilizado. Idoso. Epidemiologia. Fatores de risco. Saúde pública.

INTRODUCTION

The projection for 2050 is that about 20% of the world population will be composed of elders, including approximately 2.2 million centenarians – a rate that is 15 times higher than the current one[1].

Studies show that one of the main problems faced by the elderly, especially poorer ones, with the increasing life expectancy, are the sequels that compromise their independence and autonomy. In this context, the functional capacity appears as an important factor to identify the level of independence and autonomy in this population. Among the elderly, functional incapacity leads to reduced physical and mental abilities that are necessary to conduct their basic and instrumental activities of daily life, as well as inclusion in society[2,3].

Increasing aging, especially for those who have some level of functional incapacity, is a challenge for public policies that need to deal with the need to transfer resources for needs such as the increasing number of hospitalizations and the longer periods of hospital bed occupation, besides the interference with aspects involving the quality of life of the elderly. Health planning needs to consider the peculiarities of this population and their needs[4,5].

With the re-edition of the National Health Policy for the Elderly Population (PNSPI), in 2006, functional capacity began to organize the axes of public policies addressed to the elderly population, dividing this public into two large subgroups: independent and fragile elders[6]:

1. independent elders: people who may or may not have a disease and are able to live independently and in an anonymous form in the family and social environment;
2. fragile elders – or in the process of weakening: individuals who, for any reason, present specific conditions that compromise or jeopardize their functional capacity.

However, the term fragile is not only related with the loss of functionality, that is, loss of autonomy and independence for the accomplishment of activities of daily life[7,8].

With the model proposed by Fried et al., individuals are classified as:

1. fragile, if three or more items in the phenotype are present (unintentional weight loss, loss of palmar prehension force, exhaustion, decreasing gait, and low level of physical activities);
2. pre-fragile, if one or two items are present; and
3. not fragile, when no item is present[9].

Another challenge for elders are falls, which, according to the Kellogg International Work Group on the Prevention of Falls by the Elderly, can be defined as an unexpected, unintentional change of position, which makes the individual stay at a lower level in relation to his or her initial position, for instance, on the furniture or on the ground[10].

Pereira et al. describe that the stability of the body depends on the proper reception of information through sensorial, cognitive, nervous central system, and musculoskeletal system components, in an integrated manner. The cumulative effect of changes related to age, diseases, and inappropriate environment may lead to falls[11].

The main risk factors for falls presented in the studies by Perracini and Ramos and Schiaveto were the presence of muscle weakness, history of falls, gait and balance deficit, use of gait assistive devices, visual deficit, compromised activities of daily life, depression, cognitive decline and 80 years of age or more. And the most frequent causes were accidental or related with the environment, balance and gait disorder, muscle weakness, dizziness and vertigo, pain, medication, postural hypotension, visual disorders, falls from bed, and syncope[12,13].

In Duarte`s study, the intrinsic factors related with falls among the elderly were poor health self-evaluation, low visual and auditory acuity, using four or more medications a day, having a chronic condition, inadequate body mass index (BMI), joint disorders, and difficulties to bathe alone[14].

Knowing these items, it is possible to identify the frailty process early, allowing more adequate prevention[7].

The fall, which is very common among the elderly, may affect functional capacity and lead to losses in autonomy and independence[12]. Its most common consequences are fractures, immobility, restricted activities, institutionalization, health decline, psychological damage such as fear of falling again, besides the risk of death, and the increasing costs with health care and social losses related to family[12]. However, the fall is not only an adverse outcome of frailty, but it can also be seen as a causal factor, and that is the focus of this study[15].

Since frailty is a non-immediate consequence of the fall, its importance for the occurrence of deaths may be hidden, not perceived or accounted for as a triggering factor for falls. This process cannot be shown in cross-sectional studies, and it may even be difficult to observe in longitudinal studies[15].

The Study Health, well-being and aging (SABE) provides a proper design for this type of investigation. So far it is constituted of three stages, conducted in 2000, 2006, and 2010, and allows a research about the prevalence of falls and frailty in 2006, besides the incidence of frailty from 2006 to 2010; falls are its main independent variable.

OBJECTIVE

To assess whether the occurrence of falls in the year prior to the interview is associated with the frailty components after a four-year period.

METHODS

This study aimed at contributing with part of SABE, multicenter study coordinated by the Pan American Health Organization (PAHO), and characterized as being exploratory, retrospective, with quantitative approach.

In 2000, SABE was a cross-sectional, simultaneous, comprehensive study, elaborated to be comparable with the other centers. It was the first of this kind in the region of Latin America and the Caribbean. In 2006, it became a longitudinal study to assess the changes in the life and health conditions of elders in the city of São Paulo, which occurred with time and its determining factors. It was replicated in 2010 and 2015, with the same objectives and similar instruments.

Therefore, the objective was to locate the 2,143 elderly people interviewed in 2000 in order to reassess them by applying a similar questionnaire. In 2006, 1,115 people were located and interviewed again (the 1,028 that were not interviewed correspond to deaths, moving to other cities, institutionalization, refusal to participate, and because they were not located); in 2010, 748 individuals were interviewed.

The data for this article were obtained from the second round of SABE, conducted in 2006, when 1,413 elders were interviewed, and formed a sample representing the city of São Paulo.

Individuals considered to be fragile, according to Fried's model, were excluded, resulting in 1,207 elders in the beginning of the study. For the purposes of this article, however, elders considered as non-fragile in the beginning of follow-up are those mentioned as non-fragile and pre-fragile in Fried's original classification. The explanatory variables were the falls occurred in the year prior to the 2006 study.

In 2010, the survivors were assessed regarding the five components of frailty, which constitute the dependent variables. A statistical test with sample design correction (Rao-Scott) was applied to show the association between frailty and falls, in the beginning of the study.

The significance levels of each comparison were corrected using the Holm-Bonferroni technique, in order to maintain the general level of 0.05 for the global inference of the results.

This study was sent to the Research Ethics Committee (CEP) of Hospital das Clínicas of RibeirãoPreto, so that its ethical aspects could be evaluated. SABE was approved by the CEP of the Public Health School at Universidade de São Paulo (FSP-USP).

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RESULTS

Of the 1,142 individuals in the 2006 sample, 1,397 registered falls in the year prior to the interview and evaluation of frailty. Out of these, 443 reported falls, 626 presented with pre-fragility, and 192 were under fragility conditions (Table 1).

The elders who did not report falls and were pre-fragile, represented 37.8% of the sample. Those who reported falls and were pre-fragile, accounted for 51%, whereas 7.7% were under conditions of fragility and had not reported falls; 10.5% mentioned falls and were considered fragile.

We observed that the number of elders without the phenotype for fragility is higher among those who did not report the occurrence of falls (54.5%). Pre-fragility and fragility were higher among elders who had fallen.

Out of the 1,207 non-fragile elders who reported falls or not, 476 were men and 731 were women. From this total, 32.4% were aged between 60 and 64 years, and only 2.4% were aged 85 years or more.

DISCUSSION

The feminization of the elderly found in the study corroborates several analyses. Data from the last National Household Sample Survey[16], publicized by the Brazilian Institute of

Table1. Relation of elders as to the occurrence of falls and fragility in São Paulo, 2006.

Falls in the previous year	Fragility							
	Non-fragile		Pre-fragile		Fragie		Total	
	n=1,397				p<0.001			
	n*	%**	n*	%**	n*	%**	n*	%**
No	444	54.5	393	37.8	117	7.7	954	100.0
Yes	135	38.5	233	51.0	75	10.5	443	100.0
Total	579	50.0	626	41.5	192	8.5	1.397	100.0

Source: SABE, 2006.
*Absolute numbers in the unweighted analysis; **the percentages are a result of the sample weight.

Geography and Statistics (IBGE), in 2013, indicate that 103.5 million women lived in Brazil, corresponding to 51.4% of the population.

The non-fragility among the elderly reduces with age. Table 2 shows that in the group between 60 and 64 years old, the percentage of non-fragile men is 34.6%, whereas women represent 30.8%. Considering 90 years of age or more, the levels are 0.6% for men and 0.8% for women, corroborating a study by Rockwood et al., who found an association between fragility and advanced age[17].

An analysis conducted in the United States verified that 3–7% of the people aged more than 65 years were fragile, increasing the percentage from 20 to 26%, considering people older than 80 years. For the elderly who are older than 90 years, the index reaches 32%. This may happen because those at an older age generally present more chances of homeostatic decompensation in the face of acute, physical, social, or psychological events[18].

Of the 1,207 elderly people who were not fragile and had answered about the falls, the mean age was 72.7 years, with standard deviation of 8.7. Minimum age was 60 years, and maximum age was 102 years.

As to fragility components, Table 3 shows that

1. considering people who practiced reduced physical activity, with no falls = 35.2%, falls = 34%, risk ratio—RR=0.97 and p=0.736;
2. if there was a reduction in prehension force, with no falls = 21.8%, falls = 31.5%, RR=1.44, and p=0.003;
3. if there was reduction in gait velocity, with no falls = 19.3%, falls = 23.8%, RR=1.23, and p=0.135;

Table 2. Distribution of elders in the city of São Paulo, non-fragile, as to age and sex in 2006.

Age (years)	Sex					
	Men		Women		Total	
	n*	%**	n*	%**	n*	%**
60 to 64	121	34.6	162	30.8	283	32.4
65 to 69	88	30.1	142	28.7	230	29.3
70 to 74	67	16.4	126	19.4	193	18.2
75 to 79	70	11.7	129	12.0	199	11.9
80 to 84	75	4.8	97	5.3	172	5.1
85 to 89	42	1.8	57	2.9	99	2.4
≥ 90	13	0.6	18	0.8	31	0.7
Total	476	100.0	731	100.0	1.207	100.0

Source: SABE, 2006.
*Absolute numbers in the unweighted analysis; **the percentages are a result of the sample weight.

Table 3. Percentage of elders positive for the phenotype components of fragility in 2010, according to the occurrence of falls in the year prior to the 2006 interview.

Falls in the previous year (%)*						
Fragility components	No	Yes	Total	Relativerisk	P value (Rao-Scott)	Significance level
Reduced physical activity	35.2	34.0	34.9	0.97	0.736	0.050
Reduced manual prehension force	21.8	31.5	24.4	1.44	0.003	0.013
Reduced gait velocity	19.3	23.8	20.4	1.23	0.135	0.017
Weight loss	5.9	7.8	7.2	1.32	0.346	0.025
Exhaustion	7.6	14.7	9.5	1.93	0.003	0.010

*Percentages calculated with weight due to sample design.

4. weight loss, no falls = 5.9%,falls = 7.8, RR= 1.32, and p=0.346; and
5. exhaustion, no falls = 7.6%, falls = 14.7, RR=1.93, and p=0.003.

Falls are more common among elders with reduced prehension force, reduced gait velocity, weight loss, and exhaustion.

It is a known fact that palmar prehension force is a measure that estimates global muscle force among the elderly, since it is related with sedentary people, with body mass deficit, health problems, and functional limitation in activities that require the participation of upper and lower limbs[19-21].

We can associate reduced manual prehension force, weight loss, and exhaustion with sarcopenia, since this consequence of the human being aging process, leads to loss of mass and muscular strength. This condition can lead to reduced balance, loss of agility, and consequently, falls and fragility[22-24]. Reduced gait velocity can also be related with sarcopenia or decreased proprioceptive and vestibular activities, affecting balance[25]; however, the fragility components to which the occurrence of falls is associated are reduced manual prehension force (p = 0.003) and exhaustion (p = 0.003).

CONCLUSION

This paper aims at contributing with health care groups, raising awareness of patients, conducting household guidance, and investigating the risks of falls in the community, thus preserving the health of the elder, besides collaborating with the reduction of negative impacts for the family and expenses for public health.

The conduction of longitudinal studies is suggested in order to define the causality of falls among the elderly, considering aspects of temporality between the exposure and the event. Besides, it is important to conduct studies to assess the efficacy of strategies used in the prevention of falls, allowing to measure results, provide the necessary adjustments and apply them in other populations so that it is possible to share experiences.

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