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Falls among the elderly: risk factors in a population-based study

Quedas em idosos: fatores associados em estudo de base populacional

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ABSTRACT: *Purpose:* The aim of the present study was to identify factors associated with the occurrence of falls among elderly adults in a population-based study (ISACamp 2008). *Methods:* A population-based cross-sectional study was carried out with two-stage cluster sampling. The sample was composed of 1,520 elderly adults living in the urban area of the city of Campinas, São Paulo, Brazil. The occurrence of falls was analyzed based on reports of the main accident occurred in the previous 12 months. Data on socioeconomic/ demographic factors and adverse health conditions were tested for possible associations with the outcome. Prevalence ratios (PR) were estimated and adjusted for gender and age using the Poisson multiple regression analysis. *Results:* Falls were more frequent, after adjustment for gender and age, among female elderly participants (PR = 2.39; 95% confidence interval (95%CI) 1.47 – 3.87), elderly adults (80 years old and older) (PR = 2.50; 95%CI 1.61 – 3.88), widowed (PR = 1.74; 95%CI 1.04 – 2.89) and among elderly adults who had rheumatism/ arthritis/ arthrosis (PR = 1.58; 95%CI 1.00 – 2.48), osteoporosis (PR = 1.71; 95%CI 1.18 – 2.49), asthma/ bronchitis/ emphysema (PR = 1.73; 95%CI 1.09 – 2.74), headache (PR = 1.59; 95%CI 1.07 – 2.38), mental common disorder (PR = 1.72; 95%CI 1.12 – 2.64), dizziness (PR = 2.82; 95%CI 1.98 – 4.02), insomnia (PR = 1.75; 95%CI 1.16 – 2.65), use of multiple medications (five or more) (PR = 2.50; 95%CI 1.12 – 5.56) and use of cane/ walker (PR = 2.16; 95%CI 1.19 – 3.93). *Conclusion:* The present study shows segments of the elderly population who are more prone to falls through the identification of factors associated with this outcome. The findings can contribute to the planning of public health policies and programs addressed to the prevention of falls.

Keywords: Aging. Aged. Accidental falls. Health surveys. Cross-sectional studies. Risk factors

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RESUMO: *Objetivo:* Identificar fatores associados à ocorrência de quedas em idosos, em estudo de base populacional (ISACamp 2008). *Métodos:* Trata-se de estudo transversal, com amostra tomada por conglomerados em dois estágios, totalizando 1.520 idosos residentes na área urbana do município de Campinas, São Paulo. Foram analisadas as ocorrências de quedas, relatadas como o principal acidente sofrido nos últimos 12 meses, segundo variáveis socioeconômicas, demográficas e de morbidades. Foram estimadas razões de prevalências (RP) ajustadas para idade e sexo por meio de regressão múltipla de Poisson. *Resultados:* Foram identificados com maior ocorrência de quedas, após ajuste por idade e sexo, os idosos do sexo feminino (RP = 2,39; intervalo de confiança de 95% (IC95%) 1,47 – 3,87), os mais idosos (80 anos e mais) (RP = 2,50; IC95% 1,61 – 3,88), os viúvos (RP = 1,74; IC95% 1,04 – 2,89) e os idosos que apresentavam reumatismo/artrite/artrose (RP = 1,58; IC95% 1,00 – 2,48), osteoporose (RP = 1,71; IC95% 1,18 – 2,49), asma/bronquite/enfisema (RP = 1,73; IC95% 1,09 – 2,74), dor de cabeça (RP = 1,59; IC95% 1,07 – 2,38), transtorno mental comum (RP = 1,72; IC95% 1,12 – 2,64), tontura (RP = 2,82; IC95% 1,98 – 4,02), insônia (RP = 1,75; IC95% 1,16 – 2,65), uso de muitos medicamentos (cinco ou mais) (RP = 2,50; IC95% 1,12 – 5,56) e uso de bengala/andador (RP = 2,16; IC95% 1,19 – 3,93). *Conclusão:* Por meio da identificação desses fatores, o presente estudo aponta os segmentos de idosos mais susceptíveis às quedas e, dessa forma, pode contribuir para o planejamento de políticas públicas e programas de saúde voltados à prevenção de quedas e redução de suas consequências.

Palavras-chave: Envelhecimento. Idoso. Acidentes por quedas. Inquéritos epidemiológicos. Estudos transversais. Fatores de risco

INTRODUCTION

The increasing proportion of elderly people in the Brazilian population brings up the need to analyze and discuss the main impairing events that affect this age group¹. Among these events, the occurrence of falls is relevant, since it has the potential of causing serious risks to health and to the life of the elderly; therefore, it is a very frightening situation¹.

In Brazil, in 2010, 10,425 deaths were caused by falls, out of which 65.2% involved elderly people². It is estimated that the Unified Health System (SUS), in Brazil, spent approximately R\$ 57.61 million with hospitalizations caused by falls in 2009, and in 2006 this amount was of R\$ 49 million².

The fall results from the loss of postural balance, and it can be related to the sudden failure of neural and osteoarticular mechanisms involved in postural maintenance³. The frequency of falls increases significantly with the biological changes associated with age. With aging, the structure and function of skeletal muscles change. In terms of structure, muscle mass decreases because the number and the size of muscle fibers decline after the end of adulthood³. The loss of muscle mass and, consequently, muscle strength, is directly

related with the reduction of mobility and impairment in physical performance, which contributes with the increasing risk of falls⁴.

conducted in different countries point out to the relevance of falls among elderly people, and detect annual frequencies ranging from 6.5% to 42%, depending on the country and on the adopted methods for collecting information^{5,6}.

Factors related to falls have been classified as intrinsic, which result from physiological changes related to aging, diseases and effects of medicines, and as extrinsic, which are related to circumstances and environmental conditions⁷.

Several sociodemographic factors^{1,8,9} and those related to housing conditions, family arrangements^{1,10,11}, diseases^{1,9} and visual and physical impairment^{1,11} have been associated with falls. Indicating factors that are associated with the occurrence of falls among the elderly is a relevant task, since it can contribute with subsidies for public policies and health programs addressed to preventing accidents and reducing their consequences^{1,12}.

Considering the serious damage that falls can cause for the health of the elderly, besides their social and economic implications, the objective of this study was to identify factors associated with the occurrence of falls among elderly people living in the city of Campinas, São Paulo.

METHODS

This is a cross-sectional, population-based study conducted with a sample of non-institutionalized elderly people (60 years old or more), living in an urban area in the city of Campinas, São Paulo. In 2008, the city had a little more than 1 million inhabitants, and 11% of them were elderly people (60 years old or more). The data in this study are part of the health household survey (ISACamp 2008), conducted from February, 2008, to April, 2009. The survey aimed at obtaining information from several health dimensions regarding three age-related domains: adolescents (10 – 19 years old), adults (20 – 59 years old) and elderly people (60 years old or older).

The minimum number of people to compose the sample of each domain was established by considering the estimation of a 50% proportion, with 95% confidence interval (95%CI), sampling error ranging between 4 and 5 percentage points, and design effect estimated at 2. Therefore, a minimum number of 1,000 interviews was established for each age domain.

The survey sample was obtained by probability sampling procedures, in two-stage clusters: census and household sectors. In the first stage, 50 census sectors were raffled with probability proportional to size (number of households). For these 50 raffled sectors, households were updated in order to enable a posterior raffle. In the second stage, in order to reach the necessary sample size, 2,150, 700 and 3,900 households were independently raffled to obtain the minimum number of adolescents, adults and elderly participants, respectively.

Information was obtained by a structured questionnaire, which was applied by trained and supervised interviewers. Inclusion criteria were: being at least 60 years old and accepting to answer the questionnaire, by signing the informed consent form.

In cases of elderly people with mental disorder, stroke sequels or any another reason that prevented participants from answering the questionnaire, a family member was requested to help with data collection. The analyzed variables were:

- Occurrence of falls reported as the main accident in the past 12 months obtained by the questions: “Were you involved in any kind of accident in the past 12 months?” (and the following was mentioned to the interviewee: traffic accident, falls, burns, events at home, at work etc.) and “Which was the main accident you were involved in in the past 12 months?”.
- Other analyzed variables about falls reported as being the main accident in the past 12 months: place of occurrence; whether or not it caused limitations in daily activities and for how many days; whether or not the person was bedridden, and for how many days; and if the person needed medical care because of the fall.
- Socioeconomic and demographic variables: sex, age, marital status, schooling years, paid occupation, monthly per capita family income in minimum wages and type of household.
- Chronic morbidities, reported as being diagnosed by a doctor or other health professional: hypertension, diabetes, tumor/cancer, rheumatism/arthritis/arthrosis, osteoporosis, asthma/bronchitis/emphysema, tendinitis/repetitive strain injury, and the total number of reported chronic diseases among those in the checklist.
- Health problems/symptoms: frequent headache, backache, dizziness, insomnia, and number of reported health problems among those in the checklist
- Common mental disorder (CMD), assessed by the Self Reporting Questionnaire (SRQ 20), with cutoff point of 6 or more¹³.
- Number of medications used in the past three days.
- Use of cane/walker and wheelchair.

The survey data were typed into a data base developed with the software EpiData 3.1 (Epidata Association, Odense, Denmark), and were submitted to an evaluation of consistency. For the analyses in this study, estimates were produced with 95%CI. The associations between variables and the falls that occurred in the past 12 months were analyzed by the χ^2 test. Besides, simple regression and Poisson multiple regression were used to estimate crude and adjusted prevalence ratios (PR) for sex and/or age.

The analyses were conducted with the software Stata 11.0 (Stata Corp, College Station, United States) and used svy commands which incorporate the necessary weights according to sampling design.

The project of this study was approved by the Ethics Committee of the School of Sciences at *Universidade Estadual de Campinas*, report n. 079/2007.

RESULTS

Among the selected households to obtain the sample of elderly people, there was a 6.5% loss, due to the impossibility of finding a resident or because the resident refused to describe the individuals living in that household. Out of the elderly people who were selected from the households, and were supposed to be interviewed, 2.3% refused to participate. Therefore, 1,520 elderly people were analyzed in this study.

From the studied population, 59.5% were female, with mean age of 69.9 years old; 6.5% reported falls as being the main accident in the past 12 months. After adjustment for age and/or sex, the main occurrences of falls were observed among female participants (PR = 2.39; 95%CI 1.47 – 3.87), older elderly people (80 years old or more) (PR = 2.50; 95%CI 1.61 – 3.88) and widow(ers) (PR = 1.74; 95%CI 1.04 – 2.89) (Table 1).

Among chronic diseases, the associations deriving from multiple analyses were: rheumatism/arthritis/arthrosis (PR = 1.58; 95%CI 1.00 – 2.48), osteoporosis (PR = 1.71; 95%CI 1.18 – 2.49) and asthma/bronchitis/emphysema (PR = 1.73; 95%CI 1.09 – 2.74). With regard to other health issues, significant associations with falls were observed with: headache (PR = 1.59; 95%CI 1.07 – 2.38), dizziness (PR = 2.82; 95%CI 1.98 – 4.02), insomnia (PR = 1.75; 95%CI 1.16 – 2.65) and CMD (PR = 1.72; 95%CI 1.12 – 2.64). The occurrence of falls was increasing according to the number of morbidities and number of reported health problems, even after adjustments (Table 2). Besides, a significant association was observed between falls and the higher number of used medications (five or more) (PR = 2.50; 95%CI 1.12 – 5.56) and use of cane or walker (PR = 2.16; 95%CI 1.19 – 3.93) (Table 3).

It was possible to observe that elderly people fell mostly in their houses (64%), followed by occurrences in the street (26%). Among the elderly who reported falls as the main accident they were involved in in the past 12 months, 56.7% limited their daily activities, being 57.4% for three days or longer; 58.6% were bedridden, being 58.8% for three days or longer; and 71.2% required medical care because of the fall (Table 4).

DISCUSSION

The occurrence of falls reported as the main accident in the past 12 months was of 6.5%. This frequency is similar to that observed in the study by Gang et al.⁵, conducted in Beijing, and inferior to the mean found in studies assessing the occurrence of falls, regardless of their severity^{1,9}. This study considered only those falls that were considered to be the main accident the person was involved in in the past 12 months, so the most severe falls had more chances of being reported, which may have underestimated the result.

The higher occurrence of falls was observed among females, which is consistent with the findings in national and international literature^{1,8,9,14}. Campbell et al.¹⁵, in a prospective study, examined the variables that increased the relative risk of women falling when

Table 1. Occurrence of falls as the main accident reported in the past 12 months according to socioeconomic variables of individuals aged 60 years old or more. ISACAMP 2008 (n = 1,520).

Variables	n (%)	Occurrence of falls (%)	PR (95%CI)	Adjusted PR (sex and/or age) (95%CI)
Sex		0.0002*		
Male	616 (42.8)	3.4	1	1
Female	904 (57.2)	8.7	2.55 (1.55 – 4.19)	2.39 (1.47 – 3.87)
Total	1520 (100)	6.5		
Age		0.0012*		
60 to 69 years old	821 (54.0)	4.6	1	1
70 to 79 years old	499 (32.8)	7.2	1.55 (0.97 – 2.49)	1.51 (0.97 – 2.36)
80 years old or more	200 (13.2)	12.5	2.70 (1.71 – 4.28)	2.50 (1.61 – 3.88)
Marital status		0.0000*		
Married	848 (56.6)	3.9	1	1
Widow(er)	452 (28.9)	11.1	2.79 (1.93 – 4.05)	1.74 (1.04 – 2.89)
Other	220 (14.5)	7.2	1.83 (1.07 – 3.10)	1.53 (0.89 – 2.63)
Schooling (years)		0.3319*		
0 to 3	547 (34.8)	7.8	1.61 (0.80 – 3.26)	1.18 (0.62 – 2.25)
4 to 7	516 (33.6)	6.3	1.31 (0.67 – 2.54)	1.10 (0.62 – 1.94)
8 to 11	100 (6.6)	6.9	1.43 (0.55 – 3.75)	1.42 (0.58 – 3.44)
12 or more	356 (25.0)	4.8	1	1
Paid occupation		0.1264*		
No	1202 (78.6)	6.9	1	1
Yes	317 (21.4)	4.8	0.70 (0.43 – 1.12)	1.27 (0.72 – 2.22)
Family Income per capita (in minimum wages)		0.2770*		
< 0.5	241 (15.7)	9.0	1	1
0.5 to 1	367 (23.4)	6.7	0.74 (0.44 – 1.27)	0.74 (0.44 – 1.23)
1 to 4	738 (48.6)	5.4	0.60 (0.32 – 1.12)	0.63 (0.33 – 1.17)
> 4	174 (12.3)	6.9	0.76 (0.43 – 1.34)	0.87 (0.52 – 1.46)
Type of household		0.4715*		
House	1302 (84.8)	6.6	1	1
Apartment	186 (13.4)	5.1	0.78 (0.46 – 1.31)	0.85 (0.51 – 1.39)
Others	32 (1.8)	9.2	1.39 (0.41 – 4.66)	1.53 (0.59 – 3.98)

PR: prevalence ratio; 95%CI: 95% confidence interval; *p value in the χ^2 test.

Table 2. Occurrence of falls reported as the main accident in the past 12 months, according to health conditions, among individuals aged 60 years old or more. ISACAMP 2008 (n = 1,520).

Variables	n	Occurrence of falls (%)	p-value*	PR (95%CI)	Adjusted PR (sex and age) PR (95%CI)
Chronic morbidities					
Hypertension	819	7.4	0.1934	1.38 (0.83 – 2.28)	1.18 (0.72 – 1.93)
Diabetes	333	5.1	0.2117	0.74 (0.46 – 1.20)	0.72 (0.45 – 1.15)
Tumor/cancer	81	6.0	0.8729	0.93 (0.39 – 2.25)	0.98 (0.45 – 2.15)
Rheumatism/arthritis/arthrosis	400	10.1	0.0045	1.93 (1.22 – 3.04)	1.58 (1.00 – 2.48)
Osteoporosis	232	12.7	0.0000	2.42 (1.66 – 3.53)	1.71 (1.18 – 2.49)
Ashtma/bronchitis/emphysema	93	12.0	0.0042	1.98 (1.23 – 3.17)	1.73 (1.09 – 2.74)
Tendinitis/repetitive strain injury	76	11.0	0.1259	1.77 (0.80 – 3.92)	1.74 (0.81 – 3.74)
N. of chronic morbidities			0.0109		
0	288	2.3		1	1
1 to 2	707	6.1		2.57 (1.13 – 5.83)	2.17 (0.98 – 4.80)
3 or more	503	8.7		3.68 (1.52 – 8.92)	2.57 (1.08 – 6.12)
Health problems					
Headache	290	9.1	0.0364	1.54 (1.02 – 2.33)	1.59 (1.07 – 2.38)
Backache	667	7.5	0.1276	1.34 (0.91 – 1.97)	1.25 (0.86 – 1.81)
Dizziness	294	14.1	0.0000	3.02 (2.14 – 4.25)	2.82 (1.98 – 4.02)
Insomnia	349	10.7	0.0005	2.04 (1.37 – 3.05)	1.75 (1.16 – 2.65)
N. of Health Problems			0.0000		
0	412	2.6		1	1
1 to 2	740	6.1		2.29 (1.19 – 4.42)	2.19 (1.18 – 4.04)
3 or more	368	11.5		4.26 (2.23 – 8.13)	3.63 (1.94 – 6.76)
Common mental disorder	276	11.1	0.0009	2.03 (1.34 – 3.08)	1.72 (1.12 – 2.64)

Table 3. Occurrence of falls reported as the main accident in the past 12 months, according to the use of medications and gait assistive devices among individuals aged 60 years old or more. ISACAMP 2008 (n = 1,520).

Variables	n	Occurrence of falls (%)	p-value*	PR (95%CI)	Adjusted PR (sex and age) PR (95%CI)
N. of medications			0.0027		
0	293	2.6		1	1
1 to 2	557	5.8		2.17 (0.88 – 5.32)	1.86 (0.81 – 4.27)
3 to 4	361	7.9		2.97 (1.24 – 7.12)	2.19 (0.99 – 4.86)
5 or more	305	9.8		3.70 (1.55 – 8.80)	2.50 (1.12 – 5.56)
Use a cane/walker	99	17.2	0.0001	3.00 (1.77 – 5.08)	2.16 (1.19 – 3.93)
Using a wheelchair	27	12.2	0.2266	1.91 (0.54 – 6.71)	1.81 (0.64 – 5.12)

compared to men, and, even by controlling the effect of numberless variables, it was still observed that the risk among females was twice as high (95%CI 1.40 – 2.92). Fried et al.¹⁶ considered that maybe women fall more often because of the lower amount of lean mass and muscle strength they present in relation to men at the same age group. According to Foldvari et al.¹⁷, women lose muscle strength earlier than men, getting closer to the limit in which power could compromise the functional status. Women would also be more exposed to extrinsic factors that cause sarcopenia (degenerative loss of mass and muscle strength)¹⁸, and they are also more exposed to household activities^{19,20}.

The occurrence of falls was increasing with age, being 2.5 times more common among elderly people aged 80 years old or more in comparison to those aged 60 to 69 years old. This result is attributed to progressive balance loss and changes in muscle and bone mass, which take place during the aging process^{8,10,21}. Studies have shown that one of the ways to minimize balance and muscle mass deficits that occur in this process is the regular practice of physical exercises²², which contributes with the improvement of functional capacity, balance, strength, coordination and movement velocity, thus promoting safer gait and preventing falls^{18,23}.

As to marital status, falls affected widows and widowers almost twice as much, even after adjustment for age and sex. Siqueira et al.¹⁰ consider that mutual care between partners could explain the lower occurrence of falls among those who live with a partner⁸. Studies by Perracini and Ramos¹ and Siqueira et al.⁸ also found increasing occurrence of falls for elderly widows and widowers, and authors analyze that the fact of living alone, which is more common in this condition, could lead the elderly person to have more tasks that, when associated with functional instability, would produce more situations connected to risks of falls.

Table 4. Characteristics related to falls reported as the main accident in the past 12 months among individuals aged 60 years old or more according to sex. ISACAMP 2008 (n = 1,520).

Variables	Total n (%)	Male n (%)	Female n (%)	p-value
Place of occurrence				0.9265
In the household	64 (64.0)	13 (61.6)	51 (64.6)	
At work	1 (0.9)	0 (0.0)	1 (1.2)	
In the street	26 (26.0)	6 (28.7)	20 (25.2)	
Others	9 (9.1)	2 (9.7)	7 (9.0)	
Limitation of current skills				0.7275
No	43 (43.3)	10 (47.1)	33 (42.2)	
Yes	57 (56.7)	11 (52.9)	46 (57.8)	
For how many days?				0.1335
One to two	11 (42.6)	5 (55.6)	6 (24.0)	
Three or more	23 (57.4)	4 (44.4)	19 (76.0)	
Need to be bedridden?				0.0956
No	24 (41.2)	2 (18.2)	22 (46.8)	
Yes	34 (58.6)	9 (81.8)	25 (53.2)	
For how many days?				0.0756
One to two	14 (41.2)	6 (66.7)	8 (32.0)	
Three or more	20 (58.8)	3 (33.3)	17 (68.0)	
Had medical care?				0.1863
No	29 (28.8)	4 (18.1)	25 (32.0)	
Yes	71 (71.2)	17 (81.9)	54 (68.0)	

The frequency of falls reported as the main accident in the past 12 months significantly increased with the number of reported diseases and health problems. It is known that pains and health problems contribute with functional decline and increasing muscle weakness, associated with mobility limitations, and this may lead these people to be more prone to falls^{24,25}.

Among the analyzed diseases, there was an association with rheumatism/ arthritis/ arthroses and osteoporosis. A study conducted in Juiz de Fora, Minas Gerais⁹, also showed the association between osteoporosis and falls. Arthritis/ arthrosis was also associated with falls in other studies^{5,12,16}. Joint disorders and osteoporosis contribute with the reduced

physical capacity of the elderly, causing pain, influencing balance and postural control, and increasing the risk of falls²⁶.

Hypertension and diabetes are not associated with the occurrence of falls in this study, as observed in the study by Lin et al.¹⁴. Concerning diabetes, studies conducted in other countries^{27,28} found an association between this disease and falls, and report that the latter can be associated to complications related to diabetes, such as peripheral neuropathy, reduced vision, diabetic foot ulcers and damaged kidney function²⁷.

Among the health problems, dizziness was mostly associated with the occurrence of falls. Bretan et al.²⁹ also found an association between dizziness and the occurrence of falls among elderly attending an outpatient clinic in the city of Botucatu, São Paulo, as well as the cohort study by Moraes et al.³⁰, conducted with the population of elderly people in Cuiabá, Mato Grosso, in which dizziness was present among 51% of the individuals who reported falls in the past year.

It is important to emphasize that changes related to aging and systems related to body balance, as well as the higher prevalence of chronic degenerative diseases, and the chronic or multiple use of medications, among other factors, may favor the onset of dizziness or increase the intensity of this symptom, thus leading to more physical and functional limitations, and also emotional ones, in this age group, which contributes with the increasing risk of falls³¹.

Insomnia was also identified as a factor associated with the occurrence of falls, as observed in other studies^{12,32}. Insomnia represents the most common complaint related to changes in sleep among the elderly³³. From the clinical point of view, these complaints are accompanied by damage in the performance of daytime activities, indicated by at least one of the following symptoms: fatigue or lack of energy, daytime sleepiness, attention, concentration and memory deficit, irritability, hyperactivity and aggression, reduced motivation, declining professional performance and social contacts^{34,35}. Therefore, the clinical consequences of sleep-related problems among elderly people often result in increasing risk of accidents and traumas³⁶.

CMD was also associated with the occurrence of falls. It is known that CMD is constituted by a set of psychiatric non-psychotic symptoms, characterized by somatic and depressive symptoms, state of anxiety, irritability, insomnia, fatigue, difficulties related to memory and concentration³⁷. Depression, which is included in the set of CMD symptoms, was studied by Rubenstein and Josephson³⁸, who detected 2.2 more chances of falls among elderly with depression in comparison to elderly without depression. An analysis conducted in Sweden proves that stressful events, which awaken negative feelings, can be triggering factors for falls among older people³⁹.

The association between asthma/bronchitis/emphysema and falls was observed in this study, however, it was not demonstrated in other studies^{1,27}, since this association was not analyzed much⁴⁰. Headache was also associated with falls among the elderly, however, no studies were found in literature demonstrating such an association. Studies^{41,42} report that asthma and headache contribute with more vulnerability and decreasing functional capacity. The use of medications, fewer social experiences and the feeling of discomfort associated with these conditions leads to changes in physical and mental mood for the

performance of daily activities, so these aspects contribute with the establishment of a more vulnerable situation.

With regard to medications, it was observed that the higher the number of used medications, the higher the prevalence of falls. Hartikainen et al.⁴³ mention that it is extremely important to investigate each of the drugs used individually or together, since many medications present adverse reactions that may induce to the occurrence of falls.

Rezende et al.⁴⁴, in a systematic review about falls and the use of medications among the elderly, observed that the drugs that are mostly associated with the occurrence of falls are psychoactive ones, due to their sedative effects, postural hypotension, shivers, muscle relaxation and weakness, and also the diuretics, due to fatigue and hydroelectrolytic disorder⁴⁵.

With regard to the use of gait assistive devices, there was a significant association between the use of a cane/walker and the occurrence of falls, as reported in the study by Rubenstein and Josephson³⁸. However, since this is a cross-sectional study, which ignores the date in which the gait assistive device began to be used, it is not possible to make causal inferences. It is a known fact that with age, individuals tend to walk slower, to reduce the pace and to increase the support base and time of permanence in the double support phase, as a strategy to gain stability⁴⁶. Compromised gait among the elderly can increase the risk of falls⁴⁷. Therefore, the technology assisted by assistive devices enables to promote more functional independence, thus facilitating the performance of daily activities by the elderly. This technology is employed to provide support while a person walks and balances, but it can also contribute to an unsafe mobility, thus increasing the risk of falls in case of project flaws and/or inadequate use⁴⁸.

The most common place where falls occur was the household of the elderly person (64%), followed by the streets (26%). Studies show that falls happen mostly in the bedroom and in the bathroom^{49,30}, and that facilitating factors that stand out in the house are rugs, wet floor, changes in the position of furniture, little light and staircases⁷. Therefore, it is important to assess the household environment and the extrinsic factors that contribute with the occurrence of falls, as well as ways to prevent them, such as the use of non-slippery flooring material, adequate lighting, absence of rugs, support bars, and others^{7,10}.

Understanding and discussing the results obtained in this study should consider some limitations. One of them is the fact that the used question was not specific for falls, but instead, it was addressed to the occurrence of accidents in general, which included falls. So, we obtained data regarding the main accident, or the main fall that occurred in the past 12 months, which may have underestimated the results.

The collection of data about the fall being reported in the past 12 months may also be considered as a limitation, especially for the elderly, which could result in the sub-report of events.

Another limitation lies on the cross-sectional design, which does not allow to infer on the causality of the association, as observed in relation to the association with a cane or walker and the use of medications. In this study, the past three days were used as reference, including continuous medication or not. It is also possible to consider that this study was

based on data from a health survey that included more themes, so it was not specifically addressed to falls; therefore, there are not many details about the event.

By identifying the associated factors, this study indicates the segments of elderly people who are more prone to falls. Widow(ers), older and female elderly people, with joint disorders, asthma, headaches, dizziness and insomnia stand out. The presence of these characteristics and diseases should warn health professionals, caretakers and relatives of the elderly to pay special attention in terms of preventing falls. Using many medications, presenting with CMD and using equipment to gait assistive devices distinguish segments of elderly people into situations that require more care. By identifying these factors that are associated with falls, this study can contribute with the planning of public policies and health programs addressed to preventing falls and reducing their consequences.

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