Circumstances and consequences of falls among the older adults in Florianopolis. *Epi*Floripa Aging 2009*

Circunstâncias e consequências das quedas em idosos de Florianópolis. EpiFloripa Idoso 2009

Abstract

The objective was to investigate the circumstances and consequences of falling and risk factors associated with limitations in performing activities after falling. The study is part of the cross-sectional population based survey, conducted in 2009/2010, which involved 1,705 older adults (60 years and older) living in Florianopolis, SC. From the affirmative answer to the question of whether any falls occurred in the 12 months preceding the study, we investigated the circumstances and consequences of falls through a structured questionnaire. Descriptive analysis and binary logistic regression were used, with significance level of 5%. The prevalence of fall was 19% (14.3% for men and 21.5% for women). Most older adults fell while walking, 43.2% inside their homes. The main cause of falling was stumbling due to irregularities on the ground. 71% of those who fell reported injury, and 14.8% reported limitations in performing activities after the fall. There was a significant association between limitations in performing activities after the occurrence of falls and fractures. Preventing falls should be a public health concern, given that relatively easy changes can reduce the risk of falls.

Keywords: Aged. Accidental falls. Cross-sectional studies. Physical exercise. Activities of daily living. Public health.

Danielle Ledur Antes[I]

Eleonora d'Orsi[I]

Tânia R. Bertoldo Benedetti[II]

[I] Postgraduate Program in Public Health, Federal University of Santa Catarina. Florianópolis, SC. Brazil.

[II] Postgraduate Program in Physical Education, Federal University of Santa Catarina; Florianópolis, SC. Brazil.

* Research funded by the *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq – National Council for Scientific and Technological Development), process 569834/2008 2.

Corresponding author: Danielle Ledur Antes. Núcleo de Cineantropometria e Desempenho Humano (NuCiDH) – sala 42 – UFSC – Centro de Desportos - Campus Universitário - Trindade - 88040-900 Florianópolis, SC, Brazil. E-mail: danielleantes@gmail.com

Resumo

Objetivou-se investigar as circunstâncias e consequências das quedas e os fatores associados a limitações para realizar atividades após a queda. Este estudo é parte de um inquérito transversal, de base populacional e domiciliar, realizado em 2009/2010, do qual participaram 1.705 idosos (60 anos ou mais) residentes em Florianópolis, SC. Verificou-se a ocorrência de queda nos 12 meses anteriores ao estudo e, a partir da resposta afirmativa, investigaram-se as circunstâncias e consequências das quedas por meio de um questionário estruturado. Foram utilizadas a análise descritiva e a regressão logística binária, com nível de significância de 5%. Observou-se prevalência de 19% de quedas (14,3% para homens e 21,5% para as mulheres). A maioria dos idosos caiu enquanto caminhava, 43,2% dentro do domicílio. A principal circunstância da queda foi tropeço devido a irregularidades no chão. Em 71% dos idosos as quedas ocasionaram lesão e 14,8% mencionaram limitações para atividades após a queda. Verificou-se associação significante entre a limitação para realizar atividades após a queda e a ocorrência de fratura. Prevenir as quedas deve ser uma preocupação de saúde pública, visto que mudanças relativamente fáceis podem reduzir o risco de quedas.

Palavras-chave: Idoso. Acidentes por quedas. Estudos transversais. Exercício físico. Atividades cotidianas. Saúde pública.

Introduction

The increase in the population of older adults has evidenced an important public health problem: falls. They have been a frequent cause of functional loss, early admittance to Long-Term Permanence Institutions and increased morbidity and mortality in older adults[1].

Falls are defined as an unexpected, unintentional change in position that causes an individual to remain in a lower level; for example, on the furniture or on the ground. This event does not result from sudden paralysis, epileptic seizure or external forces[2].

Falls are the sixth cause of death among older adults and are responsible for 70% of the accidental deaths of people aged 75 years or older[3]. In Brazil, 30% of the older adults fall at least once a year. The contribution of falls to mortality increased from 3% to 4.5% in a period of 10 years[3].

Older adults who suffer falls present great functional decline. It has been found that 5% of the falls result in fractures, and between 5% and 10%, in injuries that require medical care[4]. In addition, falls cause psychological and social consequences, such as depression, fear of falling again, changes in behavior and attitudes that lead to a reduction in physical and social activities[5].

Falls are multifactorial events with associated intrinsic and extrinsic factors. The intrinsic risk factors include physiological alterations caused by aging, afflictions that are common at this age and the use of medicines[6]. The extrinsic factors, in turn, are the older adults' behavior and activities in relation to their environment[7]. Places that are dimly lit, unsafe, poorly planned and with architectural barriers are responsible for 30 to 50% of the falls[7].

The identification, through a population-based study, of the circumstances in which falls occur and their consequences is extremely important, as it allows the populations and individuals that are at risk to be characterized, as well as the implementation of preventive measures to avoid the

occurrence of new falls. This knowledge can contribute to the creation of programs that meet the older adults' needs and support policy-making[8].

The aim of this study was to investigate the circumstances and consequences of falls, as well as the factors associated with limitations to the performance of activities after these falls, among older adults living in the city of Florianópolis, state of Santa Catarina (Southern Brazil).

Methods

This study was based on a cross-sectional, population-based household survey entitled "*Epi*Floripa Idoso", which was carried out in 2009. It was developed in the urban zone of the city of Florianópolis, the capital city of the state of Santa Catarina, located in the Southern region of Brazil. Florianópolis' population was estimated at 408,161 inhabitants in 2009, of which 44,460 were older adults[9], totaling 10.8% of the population. It is the Brazilian capital city that has the best human development index: 0.875[10].

The reference population of the "*Epi*Floripa Idoso" study was constituted of older adults of both sexes, belonging to the age group of 60 years or older, completed in the year of the research. To define sample size, the prevalence calculation formula was used, for simple random samplins, multiplied by 2 (value related to the design effect estimated for two-stage cluster sampling), plus 20% for losses, and 15% for association studies. The Epi-Info program was utilized, version 6.04 in public domain, and the parameters were: population size equal to 44,460 older adults, unknown prevalence of the outcome (50%), level of confidence of 95%, and sampling error equal to 4 percentage points, resulting in a desirable sample size of at least 1,599 older adults.

Two-stage cluster sampling was carried out. At the first stage, all the 420 urban census tracts of the city were put in ascending order, according to the income of the head of the family, and 80 tracts were systematically drawn (eight in each income decile).

The second-stage units were the households. It was necessary to update the number of households in each tract (enrollment), as the most recent Census had been performed in 2000. The study's supervisors visited the selected census tracts and counted all the inhabited households, complying with the norms of the *Instituto Brasileiro de Geografia e Estatística* (IBGE – Brazilian Institute of Geography and Statistics). The number of households ranged from 61 to 725.

To reduce the coefficient of variation of the number of households per tract, tracts with less than 150 households were grouped and tracts with more than 500 households were divided, respecting the corresponding income decile, which produced 83 census tracts. The initial coefficient of variation was 52.7% (n = 80 tracts) and the final one was 35.2% (n = 83 tracts).

According to the IBGE (2000), the average number of inhabitants per household was, at the time, 3.1. As the age group of interest to the research corresponds to approximately 11% of the population, an average of 102 people was obtained per census tract, or one older adult per every three households. Therefore, approximately 60 households per census tract should be visited in order to find the 20 older adults. These households were systematically drawn and all the older adults living in the selected households were interviewed.

Older adults who were institutionalized (Long-Term Permanence Institutions or hospitals) were not included in the study. In the "*Epi*Floripa Idoso" study, the older adults who were not found after four visits, including one on the weekend and another in the evening, were considered losses, and refusals were considered when the person refused to answer the questionnaire.

Data collection was performed between September 2009 and June 2010. All the variables of the "*Epi*Floripa Idoso" study were collected by means of a standardized, pre-tested questionnaire, using Personal Digital Assistants (PDA). The interviews were performed by 20 interviewers who

had completed secondary education. All the interviewers were trained by the survey supervisors, who were postgraduate students that also supervised the fieldwork.

A pilot study was conducted with 99 older adults living in tracts that were not sampled for the research. Data consistency was verified on a weekly basis, and quality control was applied to 10% of the interviews, randomly selected, by means of a reduced questionnaire that was administered by telephone.

All the older adults who answered "yes" to the question *"Did you suffer any falls during the last year?"* were selected for a detailed interview about their fall.

For this investigation, a structured questionnaire containing 21 questions was developed, tested, and subsequently submitted to the process of validation of content and clarity. A 97% validity index was obtained for content and a 100% validity index was obtained for clarity.

The investigation of falls was developed simultaneously with the weekly download of the interviews of the "*Epi*Floripa Idoso" survey. The older adults were contacted through telephone calls or, in case they did not own a telephone, by means of a home visit, to answer the questionnaire about falls. The interviews, both by telephone and at home, were performed by three trained interviewers. The same procedure was followed in the interviews performed by telephone and at home.

With regard to the investigation of falls, the older adults who were not contacted after five calls, made on distinct days and at distinct times and followed by two home visits, were considered losses, as were those who refused to participate. If the older adults were not in condition to answer the interview, it was answered by an informant/caregiver, and in these cases the question about fear of falling again was not asked.

Falls caused by fainting, strokes, seizures and other similar conditions were not considered; therefore, three reports were excluded. Concerning the question about consequences of falls, when more than one type of injury was mentioned, the most severe one was selected, according to the interviewee's perception. When the interviewees answered the question about having more difficulty to perform activities after falling affirmatively, it was possible to check more than one alternative, and all the options were considered for the results.

The information about the number of falls in the 12 months that preceded the survey (one, from two to five, or more than five falls), sex, age in full years, self-reported ethnicity, marital status (married/cohabiting, single, divorced/separated, or widowed), level of schooling in full years of study and *per capita* income, were extracted from the questionnaire of the "*Epi*Floripa Idoso" study.

The dependent variable of this study was limitation to perform activities after a fall (yes/no). The following covariates were tested in an exploratory way: sex, age (60 to 69 years; 70 to 79 years; 80 years or older), marital status (married/cohabiting; no partner), level of schooling in full years of study (≤ 4 years; ≥ 5 years), *per capita* income divided in tertiles (level one ≤ R$ 450.00; level two from R$ 450.01 to R$ 1,125.00; level three ≥ R$ 1,125.01)*, time spent on the ground (≤ one minute; 2 to 14 minutes; ≥ 15 minutes), occurrence of fracture due to a fall (yes; no), loss of consciousness (yes; no), number of falls (1 fall; 2 to 5 falls; 6 or more falls) and fear of falling again (yes; no).

The descriptive statistics used were: mean, standard deviation (SD), median, absolute and relative frequency, and confidence intervals (CI) of 95%. To test the association between the outcome "limitation to perform activities after the fall" and the covariates, bivariate and multiple analysis with binary logistic regression were conducted, considering a level of significance of 95%. The variables that presented a p-value < 0.20 in the crude analysis were selected for the multiple model, remaining

In the period of study, US$ 1.00 corresponded to approximately R$ 1.80.

in the model if they reached $p < 0.05$ and/or if they adjusted to the model. The statistical analysis was performed in the Stata software (Stata Corp., College Station, United States) 9.0, with the "svy" command for complex sampling.

The project was submitted to the Ethics Committee for Research with Human Beings of the Federal University of Santa Catarina, and it was approved on 12/23/2008 under number 352/2008. All the interviewees signed an informed consent form to be interviewed. The authors of the manuscript stated that there were no conflicts of interest.

Results

Overall, 1,705 older adults participated in the "*Epi*Floripa Idoso" study (616 men and 1,089 women), and their mean age was 70.7 years (SD = 8, median of 69 years, maximum of 104 years). In the selected households, 1,911 eligible older adults were found, which resulted in a response rate of 89.2%. The reproducibility of the questions used in quality control was considered satisfactory, with *kappa* values between 0.6 and 0.9 for selected variables, such as diabetes, number of teeth, smoking, healthcare plan and self-reported ethnicity.

Among the interviewed individuals, 322 reported that they had suffered a fall during the previous year (88 men and 234 women), which is equivalent to a prevalence of 19% for the total group, 14.3% for men and 21.5% for women.

Table 1 - *Number (n), percentage (%) and confidence intervals (CI) of the circumstances and consequences of falls in 60 or more years old individuals, Florianopolis, SC, 2009/2010.*
***Tabela 1** - Distribuição absoluta (n) e relativa (%) e intervalo de confiança das circunstâncias e consequências das quedas, em indivíduos com 60 ou mais anos de idade, Florianópolis, SC, 2009/2010.*

Variable	n	%	(95%CI)
Number of falls (n=322)			
1 fall	181	56.2	(50.8; 61.7)
2 to 5 falls	122	37.9	(32.6; 43.2)
More than 5 falls	19	5.9	(3.3; 8.5)
Period of the day (n=297)			
Morning	129	43.4	(37.8.8; 49.1)
Afternoon	120	40.4	(34.8; 46.0)
Evening	48	16.2	(11.9; 20.4)
Place (n=304)			
Street near home	56	18.4	(14.0; 22.8)
Garden/courtyard	59	19.4	(14.9; 22.8)
Street far from home	30	9.9	(6.5; 13.2)
Other	28	9.2	(5.9; 12.5)
Inside the home (n=131)	131	43.1	(37.5; 48.7)
Bathroom	19	14.5	(8.4; 20.6)
Kitchen	22	16.8	(10.3; 23.3)
Living-room	19	14.5	(8.4; 20.6)
Laundry room	07	5.3	(1.4; 9.2)
Bedroom	33	25.2	(17.7; 32.7)
Stairs	09	6.9	(2.3; 11.3)
Other	22	16.8	(10.3; 23.3)
Activity at the moment (n=304)			
Walking	154	50.7	(45.0; 56.3)
Domestic activity	53	17.4	(13.1; 21.7)
Walking down stairs	22	7.2	(4.3; 10.2)
Taking a shower	13	4.3	(1.9; 6.6)
Climbing stairs	13	4.3	(1.9; 6.6)
Other	49	16.1	(11.9; 20.3)

Table 1 - Number (n), percentage (%) and confidence intervals (CI) of the circumstances and consequences of falls in 60 or more years old individuals, Florianopolis, SC, 2009/2010. (cont.)
Tabela 1 *- Distribuição absoluta (n) e relativa (%) e intervalo de confiança das circunstâncias e consequências das quedas, em indivíduos com 60 ou mais anos de idade, Florianópolis, SC, 2009/2010. (cont.)*

Variable	n	%	(95%CI)
Needed help standing up (n=304)			
Yes	157	51.6	(45.9; 57.2)
No	147	48.4	(42.7; 54.0)
Time on the ground* (n=294)			
≤ 1 minute	222	75.5	(70.6; 80.4)
2 to 14 minutes	49	16.8	(12.4; 20.9)
≥ 15 minutes	23	7.8	(4.7; 10.9)
Circumstance of the fall (n=304)			
Felt weak	14	4.6	(2.2; 6.9)
Twisted the ankle	34	11.2	(7.6; 14.7)
Felt dizzy	32	10.5	(7.1; 13.9)
Stumbled	91	29.9	(24.8; 35.1)
Slipped	68	22.4	(17.7; 27.1)
Lost balance	17	5.6	(2.9; 8.2)
Does not know/does not remember	17	5.6	(1.9; 6.6)
Other	35	11.5	(7.9; 15.1)
Factors that caused the fall (n=304)			
Rug	10	3.3	(1.3; 5.3)
Inadequate shoe	24	7.9	(4.8; 10.9)
Poor lighting	11	3.6	(1.5; 5.7)
Wet floor	44	14.4	(10.5; 18.4)
Irregularity in the ground	60	19.7	(15.2; 24.2)
Object on the floor	19	6.3	(3.5; 8.9)
Other**	78	25.7	(20.7; 30.6)
No factor	58	19.1	(14.6; 23.5)
Was feeling well (n=301)			
Yes	276	91.7	(88.5; 94.8)
No	25	8.3	(5.2; 11.4)
Alcohol intake (n=302)			
Yes	06	1.9	(0.4; 3.6)
No	296	98.0	(96.4; 99.6)
New medicine (n=302)			
Yes	06	1.9	(0.4; 3.6)
No	296	98.0	(96.4; 99.6)
Interruption in the use of a medicine (n=303)			
Yes	08	2.6	(0.8; 4.5)
No	295	97.4	(95.5; 99.2)
Self-medication (n=304)			
Yes	01	0.3	(0.00; 0.9)
No	303	99.7	(99.0; 100.3)

*Time in minutes; **Hands were occupied, in a hurry, lack of attention, etc.
**Tempo em minutos; **Por estar com as mãos ocupadas, com pressa, por falta de atenção, entre outros.*

Among the older adults who had suffered falls (n = 322), 304 answered the questionnaire about falls, corresponding to a response rate of 94.4%, equivalent between sexes. The majority of the interviews about falls was performed by telephone (287; 94.4%), and a small number through home visits (17; 5.6%).

The mean age of the group who reported falls was 72.5 years (SD = 8.2, median of 73

years), and it was similar between sexes. The mean level of schooling was 6.7 years (SD = 5.4, median of 5.0 years of study), and the major part of the interviewees reported they were white (85.2%), followed by mixed (7.9%), black (5.3%), indigenous (1.3%) and Asian individuals (0.3%). The median of the *per capita* income was R$ 583.75 (mean of R$ 1,075.28). With regard to marital status, there was a predominance of married individuals (53.4%), followed by widowed (34.5%), divorced/separated (7.4%) and single individuals (4.7%), (data not presented).

The majority of the older adults reported only one fall in the 12 months that preceded the survey, which occurred during the morning, while they were walking inside the home, in the bedroom, and the majority needed help to stand up and remained on the ground for one minute, at the most (Table 1).

The main circumstances of falls were stumbling and slipping. As many factors contributed to the occurrence of falls, the major part of the older adults reported other 37 factors (lack of attention, occupied hands, being in a hurry, among others), followed by irregularities in the ground (Table 1).

Almost all the participants reported that they were feeling well on the day of their fall and that they had not consumed alcoholic beverages. Additionally, they mentioned no alterations in the regular pattern of medication use, such as inclusion of a new medicine, interruption in the continuous use of a medicine or self-medication (Table 1).

Table 2 shows that, for the majority of the older adults, falls caused injuries, and the most frequently reported one was abrasion/scratch. The majority of them did not lose consciousness at the moment of the fall, nor did they need medical assistance on the scene. The major part did not look for medical assistance after their fall and did not modify their medication.

One fourth of the older adults restricted the performance of activities of daily living due to their fall. More than half of them answered that they were afraid of falling again. When asked about limitations to perform some activity after their fall, the majority answered negatively. Among the affirmative answers, the most frequently reported one was walking outside the home. It is important to highlight that it was possible to check more than one answer to this question (Table 2).

Among the factors associated in an independent way with limitations to perform activities of daily living after a fall, identified in the bivariate analysis, the chance of remaining on the ground for 15 minutes or more was higher (p = 0.002; OR = 4.61; 95%CI = 1.84; 11.57), in the same way that there was a higher chance of loss of consciousness (p = 0.007; OR = 5.54; 95%CI = 1.61; 19.09), of having suffered fracture due to a fall (p < 0.001; OR = 5.45; 95%CI = 2.48; 11.95) and of mentioning fear of new falls (p = 0.03; OR = 2.11; 95%CI = 1.10; 4.07) (Table 3).

In the adjusted analysis, the only variable that remained associated was fracture due to a fall (p = 0.003; OR = 4.24; 95%CI = 1.66; 10.87) (Table 4).

Discussion

The prevalence of falls found in this study was 19%, lower than the one reported by the Brazilian Ministry of Health[11] in 2007 for the Brazilian population of older adults (30%); it was also lower compared to what has been found in other national[12, 13] and international studies[14- 16]. In 2002, a population-based survey[17] was carried out in the city of Florianópolis and it also found a low prevalence of falls (11.4%); however, this survey analyzed only the three previous months. What might explain the lower prevalence in comparison to that of other studies is the fact that Florianópolis is the Brazilian capital city that has the best human development index, which implies greater access to health services, more information about healthy habits and, consequently, knowledge about risks of falls.

The prevalence of falls in women was 21.5%, while in men it was 14.3%. Studies[1,7,16,18,19] have shown that more women suffer falls than men. This may occur due to the women's greater physical

Tabela 2 - Distribuição absoluta (n) e relativa (%) e intervalo de confiança da lesão consequente da queda, perda de consciência, atendimento médico no local e após a queda, modificação da medicação, restrição das atividades diárias normais, maior dificuldade para realizar atividades após a queda, medo de cair novamente, de indivíduos com 60 ou mais anos de idade, Florianópolis, SC, 2009/2010.

Table 2 *- Number (n), percentage (%) and confidence intervals (CI) of the consequent injury of the fall, loss of consciousness, medical attendance at the scene, saw doctor after the fall, subsequent alteration of medication, restriction of normal daily activities, difficulties in performing activities after the fall, fear of reoccurrence of a fall; in 60 or more years old individuals, Florianopolis, SC, 2009/2010.*

Variable	N	%	(95%CI)
Suffered consequences (n=304)			
Yes	216	71.0	(65.9; 76.2)
No	88	28.9	(23.8; 34.1)
Main consequences (n=215)			
Fracture	28	13.0	(8.5; 17.6)
Sprain	18	8.4	(4.6; 12.1)
Abrasion/scratch	75	34.9	(28.5; 41.3)
Bruise	65	30.2	(24.0; 36.4)
Cut	21	9.8	(5.8; 13.8)
Other	08	3.7	(1.2; 6.3)
Loss of consciousness (n=304)			
Yes	13	4.3	(1.9; 6.6)
No	291	95.7	(93.4; 98.0)
Medical assistance on the scene (n=303)			
Yes	15	4.9	(2.5; 7.4)
No	288	95.0	(92.6; 97.5)
Saw a doctor after the fall (n=294)			
Yes	111	37.8	(32.2; 43.3)
No	183	62.2	(56.7; 67.8)
Modified the medication (n=304)			
Yes	26	8.5	(5.4; 11.7)
No	278	91.4	(88.3; 94.6)
Restricted activities after the fall (n=304)			
Yes	75	24.7	(19.8; 29.5)
No	229	75.3	(70.4; 80.2)
Limitation to perform activities after the fall (n=304)			
No	259	85.2	(81.2; 89.2)
Yes	45	14.8	(10.8; 18.8)
Main activities			
Walking inside the home	22	16.3	(9.9; 22.6)
Dressing up	24	17.8	(11.2; 24.3)
Taking a shower	15	11.1	(5.7; 16.5)
Walking outdoors	30	22.2	(15.1; 29.3)
Going to the bathroom on time	6	4.4	(0.9; 7.9)
Taking medication at the right time	4	2.9	(0.1; 5.9)
Cutting toenails	8	5.9	(1.9; 9.9)
Shopping	26	19.3	(12.5; 25.9)
Fear of falling again (n=266)			
Yes	152	57.1	(51.2; 63.1)
No	114	42.9	(36.9; 48.8)

Tabela 3 - Análise bivariada da associação entre limitação para realizar atividades diárias após a queda e demais variáveis, razões de chances (RC) brutas, intervalos de confiança (IC) de 95% e valor de p calculados por regressão logística, indivíduos com 60 ou mais anos de idade, Florianópolis, SC, 2009/2010.

***Table 3** - Bivariate analyses, crude odds ratio (OR), 95% confidence interval (CI), and p-value of the association between limitations on the performance of daily activities after the fall; and other variables in 60 or more years old individuals. Florianopolis, SC, 2009/2010.*

Variable	n	Limitation (%)	Crude OR (95%CI)	p-value
Sex				0.147
Male	08	9.6	1.00	
Female	37	16.5	1.88 (0.79; 4.46)	
Age group				0.862
60 to 69 years	17	13.8	0.98 (0.39; 2.42)	
70 to 79 years	20	16.1	1.18 (0.49; 2.81)	
80 years or older	08	14.0	1.00	
Level of schooling				0.482
≤ 4 years	18	13.1	1.00	
≥ 5 years	27	16.6	1.31 (0.61; 2.82)	
Per capita income				0.561
Level 1	17	14.12	1.34 (0.63; 2.84)	
Level 2	19	18.63	1.86 (0.75; 4.57)	
Level 3	09	10.98	1.00	
Marital status				0.08
With a partner	19	11.31	1.00	
Without a partner	26	19.12	1.85 (0.93; 3.71)	
Fear of falling again				0.03*
No	11	9.6	1.00	
Yes	28	18.4	2.11 (1.10; 4.07)	
Fracture				< 0.001*
No	29	15.5	1.00	
Yes	14	50.0	5.45 (2.48; 11.95)	
Time on the ground				0.002*
≤ 1 minute	23	10.4	1.00	
2 to 14 minutes	09	18.4	1.95 (0.74; 5.10)	
≥15 minutes	08	34.8	4.61 (1.84; 11.57)	
Loss of consciousness				0.007*
No	39	13.4	1.00	
Yes	06	46.2	5.54 (1.61; 19.09)	
Number of falls				0.629
1 fall	28	16.1	1.00	
2 to 5 falls	14	12.3	0.73 (0.43; 1.23)	
6 or more falls	03	18.7	1.20 (0.33; 4.42)	

*Statistically significant / **Estatisticamente significante*

Tabela 4 - Análise múltipla da associação entre limitação para realizar atividades diárias após a queda e demais variáveis, razões de chances (RC) ajustadas, intervalos de confiança (IC) de 95% e valor de p calculados por regressão logística, indivíduos com 60 ou mais anos de idade, Florianópolis, SC, 2009/2010.

***Table 4** - Multiple analyses, crude odds ratio (OR), 95% confidence interval (CI), and p-value of the association between limitations on the performance of daily activities after the fall; and other variables in 60 or more years old individuals. Florianopolis, SC, 2009/2010.*

Variable	n	Limitation (%)	adjusted OR** (95%CI)	p-value
Fear of falling again				0,153
No	11	9,6	1,00	
Yes	28	18,4	1,74 (0,81; 3,76)	
Fracture				0,003*
No	29	15,5	1,00	
Yes	14	50,0	4,24 (1,66; 10,87)	
Time on the ground				0,123
≤ 1 minute	23	10,4	1,00	
2 to 14 minutes	09	18,4	2,21 (0,69; 6,98)	
≥15 minutes	08	34,8	2,15 (0,58; 7,97)	
Loss of consciousness				0,226
No	39	13,4	1,00	
Yes	06	46,2	3,74 (0,43; 32,30)	

*Statistically significant; **Adjusted variables by sex and marital status.
**Estatisticamente significante; **Variáveis ajustadas por sexo e situação conjugal.*

vulnerability, lower amount of lean mass and of muscular strength compared to men of the same age[12], and their greater involvement in domestic activities[17].

The majority of falls occurred in the morning, as observed in other investigations[20-22]. The likely reason is that older adults normally perform daily tasks, such as domestic activities, going to the market and the bakery, in this period of the day.

Studies have identified that a higher number of falls tend to occur inside the home[4,21-23] due to irregularities in the ground[4,15,24], as observed in the present study. According to the World Health Organization (WHO), unsafe, dimly lit, poorly planned environments with architectural barriers are the most common causes of falls among older adults, responsible for 30 to 50% of them[7]. Therefore, these data are extremely useful to the planning of preventive measures against falls among older adults.

In the majority of cases, the older adults do not fall because they are performing dangerous activities (climbing up stairs or chairs); rather, this occurs when they perform daily activities such as moving[4]. This fact was verified in the present study, as the major part of the older adults fell while they were walking and performing activities of daily living, thus corroborating other investigations[15, 22].

The aging process brings changes to the individuals' pace, caused by a decrease in flexibility and mobility of hips and knees, limitation of the amplitude of ankle dorsiflexion and decrease in strength. Such limitations increase the possibility of stumbling[24]. These changes may justify stumbling or slipping as the main circumstances of falls in this study and also in other investigations[15,24].

The majority of the older adults reported

they needed help standing up and that they were feeling well at the moment of the fall, results that were similar to those of another study[24].

The present investigation found few reports of alcohol consumption on the day of the fall. Alcohol consumption seems not to be the cause of the falls, as in the study by Guimarães and Farinatti[24], few cases of falls due to the use of alcohol were reported.

Few older adults reported, in the week of the fall, to have altered the habitual pattern of medication use (including new medicine, interruption in the use of medicines or self--medication). No studies were found about falls and alterations in the routine pattern of medication use, but many investigations[3,4,7,19] associate the use of medication with falls, a fact that needs to be further studied.

Among the majority of the older adults, falls resulted in abrasion/scratch; however, fractures were the main consequence reported in other investigations[4,18,22]. Nevertheless, it is important to highlight that, although fractures were not the main consequence here, the observed percentage was 13%, higher than the one mentioned by the Brazilian Society of Geriatrics and Gerontology[3], which reports that 4% of falls result in fractures. In other studies[23,24], the majority of the older adults did not need medical assistance on the scene nor after the fall, which was also observed in the present study. This may be related to the type of injury resulting from the fall.

Among the investigated older adults, the majority did not restrict their daily activities temporarily and did not notice limitations in the performance of activities of daily living after their fall; in addition, it seems that there were not sequelae caused by these falls. Among those who did mention limitations, the most frequently reported one was walking outside the home. In the study conducted by Fabrício et al.[4], the activity that needed the greatest dependence on third parties after a fall was walking on a flat surface.

The older adults who reported limitations to perform daily activities due to their fall presented a higher chance of having remained on the ground for 15 minutes or more after their fall, experienced loss of consciousness, suffered fractures, being afraid of falling again, and the fall having resulted in injuries. This makes it clear that severe falls end up limiting the basic activities of the older adults, causing, apart from physical damage, psychological consequences, a fact that has also been confirmed by other studies[4, 5, 7].

When the older adults fall, there is a tendency to reduce their daily activities, either because they are afraid of exposing themselves to the risk of falls, or because of protective attitudes of society and relatives/caregivers[7], who restrict the participation of older adults in small activities, such as drying the dishes, sweeping the house, dressing up, and putting on shoes.

The reduction in the activities of daily living or the need of help to perform them may cause immobility and, consequently, muscle atrophy, which facilitates the recurrence of falls. Furthermore, the incapacity to perform these activities may have consequences for the older adults' relatives, who need to mobilize themselves to support their treatment and recovery[4].

In this investigation, many older adults reported being afraid of falling again, which corroborates other studies[19,23,25]. The fear of falling can be triggered both by physical consequences and by psychological and social ones, and it may cause less confidence in one's capacity to walk, contributing to functional decline, depression, feelings of abandonment and social isolation[5].

The prevention of falls among older adults should be a public health concern, as changes that are relatively easy to be implemented, such as avoiding loose rugs, objects and irregularities on the ground, may substantially reduce the risk of falls[15]. Strategies based on health policies aimed to improve/maintain the older adults' functional ability should consider programs of physical exercises that contribute positively to the prevention of falls[3,7 17].

To achieve this, it is necessary to qualify

primary healthcare professionals in order to prevent falls in the home environment and at other places. In addition, older adults should be instructed to report falls, in view of the fact that only falls with severe consequences are informed to health professionals and relatives, hindering the implementation of preventive actions against new falls.

The main limitations of this study were: (a) a possible memory bias, considering the report of falls during the previous year; (b) the fact that information on individual factors was not collected, such as changes in pace, muscular strength, balance, etc. – these factors may have contributed to the occurrence of falls, as well as the investigation of some previous diseases, such as osteoporosis, which was not verified in this study. Additionally, the lower number of severe consequences may have occurred due to the non-participation of hospitalized older adults. On the other hand, the response rate and the coefficients of reproducibility are positive points.

The results of this study allow us to conclude that the prevalence of falls in women is higher than in men, the majority of the falls occurred in the morning, inside the home, specifically in the bedroom, while the older adults move around to perform their daily activities, and as a result of stumbling. Approximately one third of the falls resulted in abrasion/scratches, without the need of medical assistance neither at the moment of the fall nor *a posteriori*, and with no need of restricting the normal daily activities. However, despite the low magnitude consequences, more than half of the older adults mentioned fear of falling again. Falls in which the older adults remained on the ground for a longer time, causing fractures and loss of consciousness and triggering the fear of falling again, were significantly associated with limitations of daily activities.

References

1. Gama ZAS, Gómez-Conesa A. Factores de riesgo de caídas en ancianos: revisión sistemática. *Rev Saúde Pública* 2008; 42: 946-56.

2. Kellogg International Work Group on the Prevention of Falls by the Elderly. The prevention of falls in later life. *Dan Med Bul* 1987; 34: 1-24.

3. Pereira SRM, Buksman S, Perracini M, Py L, Barreto KML, Leite VMM. *Quedas em Idosos - Projeto Diretrizes*. Sociedade Brasileira de Geriatria e Gerontologia; 2001.

4. Fabrício SCC, Rodrigues RAP, Costa Junior MLd. Causas e conseqüências de quedas de idosos atendidos em hospital público. *Rev Saúde Pública* 2004; 38: 93-9.

5. Organização Pan-Americana da Saúde - *OPAS. Guia Clínica para Atención Primaria a las Personas Mayores*. 3ª ed. Washington: OPAS; 2003.

6. Onaga JK, D'Elboux DMJ. Quedas em idosos: principais causas e consequências. *Ciên Saúde Colet* 2007; 4:148-53.

7. World Health Organization - WHO. World Health. *Organization global report on falls prevention in older age*; 2007.

8. Pereira C, Vogelaere P, Baptista Ft. Role of physical activity in the prevention of falls and their consequences in the elderly. *Eur Rev Aging Phys Act* 2008; 5: 51-8.

9. Instituto Brasileiro de Geografia e Estatística - IBGE. *Estimativas populacionais para o TCU. Estimativas da população para 1º de julho de 2009.* Disponível em http://www.ibge.gov.br /home/estatistica/populacao/estimativa2009/POP2009_DOU.pdf (Acessado em fevereiro de 2010).

10. Programa das Nações Unidas - PNUD. Atlas *do Desenvolvimento Humano no Brasil. 2000*. Disponível em http://www.pnud.org.br/atlas/ (Acessado em maio de 2010).

11. Ministério da Saúde. *Envelhecimento e Saúde da Pessoa Idosa. Série A. Normas e Manuais Técnicos.* Cadernos de Atenção Básica; 2007.

12. Perracini MR, Ramos LR. Fatores associados a quedas em uma coorte de idosos residentes na comunidade. *Rev Saúde Pública* 2002; 36: 709-16.

13. Lebrão ML, Laurenti R. Saúde, bem-estar e envelhecimento: o estudo SABE no Município de São Paulo. *Rev Bras Epidemiol* 2005; 8: 127-41.

14. Leveille SG, Kiel DP, Jones RN, Roman A, Hannan MT, Sorond FA et al. The MOBILIZE Boston Study: design and methods of a prospective cohort study of novel risk factors for falls in an older population. *BMC Geriatr* 2008; 8:16.

15. Li W, Keegan TH, Sternfeld B, Sidney S, Quesenberry CP, Jr., Kelsey JL. Outdoor falls among middle-aged and older adults: a neglected public health problem. *Am J Public Health* 2006; 96: 1192-200.

16. Reyes-Ortiz CA, Al Snih S, Markides KS. Falls among elderly persons in Latin America and the Caribbean and among elderly Mexican-Americans. *Rev Panam Salud Publica* 2005; 17: 362-9.

17. Benedetti TRB, Binotto MA, Petroski EL, Gonçalves LHT. Atividade física e prevalência de quedas em idosos residentes no sul do Brasil. *Rev Bras Geriatr Gerontol* 2008; 11: 145-54.

18. Siqueira FV, Facchini LA, Piccini RX, Tomasi E, Thumé E, Silveira DS et al. Prevalência de quedas em idosos e fatores associados. *Rev Saúde Pública* 2007; 41: 749-56.

19. Pinheiro MdM, Ciconelli RM, Martini LA, Ferraz MB. Risk factors for recurrent falls among Brazilian women and men: the Brazilian Osteoporosis Study (BRAZOS). *Cad Saúde Pública* 2010; 26: 89-96.

20. Álvares LM, Lima RdC, Silva RAd. Ocorrência de quedas em idosos residentes em instituições de longa permanência em Pelotas, Rio Grande do Sul, Brasil. *Cad Saúde Pública* 2010; 26: 31-40.

21. Carvalho AdM, Coutinho EdSF. Demência como fator de risco para fraturas graves em idosos. *Rev Saúde Pública* 2002; 36: 448-54.

22. Coutinho ESF, Bloch KV, Rodrigues LC. Characteristics and circumstances of falls leading to severe fractures in elderly people in Rio de Janeiro, Brazil. *Cad Saúde Pública* 2009; 25: 455-9.

23. Ribeiro AP, de Souza ER, Atie S, de Souza AC, Schilithz AO. A influência das quedas na qualidade de vida de idosos. Cien Saúde Colet 2008; 13: 1265-73.

24. Guimarães JMN, Farinatti PdTV. Análise descritiva de variáveis teoricamente associadas ao risco de quedas em mulheres idosas. *Rev Bras Med Esporte* 2005; 11: 299-305.

25. Iglesias CP, Manca A, Torgerson DJ. The health-related quality of life and cost implications of falls in elderly women. *Osteoporos Int* 2009; 20: 869-78.

Received: 23/02/12
Final version: 17/08/12
Approved: 31/10/12