

Falls among the non-institutionalized elderly in northern Minas Gerais, Brazil: prevalence and associated factors

Jair Almeida Carneiro¹
Gizele Carmen Fagundes Ramos¹
Ana Teresa Fernandes Barbosa²
Élen Débora Souza Vieira³
Jéssica Santos Rocha Silva³
Antônio Prates Caldeira⁴

Abstract

Objective: To identify the prevalence of falls and associated factors in non-institutionalized elderly persons. **Methods:** A cross-sectional study featuring a population-based sample of non-institutionalized elderly persons in a city in the north of Minas Gerais was performed. Interviews were conducted in households by trained staff using validated instruments. We investigated the associations between falls and demographic, socioeconomic and health-related factors. After bivariate analysis, the variables associated with falls to a level of 20% were analyzed together using logistic regression, assuming at this stage a significance level of 5%. **Results:** The studied population was predominantly female, married and with a low educational level. The prevalence of falls was 28.4%. The factors that were associated with falls were: female gender (OR=1.67; 95% CI: 1.13 to 2.47); negative self-evaluation of health (OR=1.49; 95% CI: 1.02 to 2.20); impaired functional mobility (Timed Up and Go test >20 seconds) (OR=1.66; 95% CI: 1.02-2.74); the occurrence of hospitalization in the previous 12 months (OR=1.82; 95% CI: 1.17 to 2.84); and frailty measured by the Edmonton Frail Scale (OR=1.73; 95% CI: 1.14 to 2.64). **Conclusions:** The prevalence of falls was high for the population studied and was related to the individual health conditions of the elderly.

Keywords: Aged. Accidental falls. Risk factors.

¹ Universidade Estadual de Montes Claros, Faculdade de Medicina, Departamento de Saúde Coletiva. Montes Claros, Minas Gerais, Brasil.

² Universidade Estadual de Montes Claros, Faculdade de Medicina, Departamento de Clínica Médica. Montes Claros, Minas Gerais, Brasil.

³ Universidade Estadual de Montes Claros, Faculdade de Medicina, Curso de Medicina. Montes Claros, Minas Gerais, Brasil.

⁴ Universidade Estadual de Montes Claros, Programa de Pós-Graduação em Ciências da Saúde. Montes Claros, Minas Gerais, Brasil.

INTRODUCTION

In recent years, the Brazilian elderly population has increased nearly twice as quickly as the general population, and is the fastest growing population segment in the country. Official records reveal that there are around 20 million people aged over 60 in Brazil at the moment, representing at least 10% of the country's population.¹ This accelerated population aging has resulted in new needs and care provisions.²

One aspect that stands out in the aging process is that related to physical disabilities and the degree of dependence of the elderly. Although functional disability is not inherent in the aging process,³ as individuals age, the chance of suffering injuries caused by accidents increases.⁴ Studies show that such injuries are among the leading causes of death among older people and falls account for up to two thirds of accidents involving the elderly, representing one of the main predictors of morbidity and mortality.⁵⁻⁸

Falls in elderly people may indicate the beginning of frailty or acute disease. Besides the previously mentioned risk of death, falls result in constant injuries and fractures, compromise activities of daily living, increase rates of institutionalization, generate a decline in general health and increase fear of falling among the elderly, which, in turn, increases the risk of subsequent falls.⁹ Falls produce deleterious consequences not only for the elderly but also increase the cost of hospitalization and other health services, and as such represent a major public health problem.¹⁰

Adequate knowledge about the occurrence of falls in the elderly and devoting the necessary attention to the problem can guide more appropriate and effective preventive measures in health facilities. Some Brazilian studies have revealed that demographic variables may be associated with the problem, such as gender,¹¹⁻¹³ age,¹⁰⁻¹⁴ the lack of a partner¹⁵ and income,¹⁴ as well as health-related variables such as the presence of comorbidities,¹⁶⁻¹⁸ polypharmacy^{15,19} and self-perception of health.¹⁴⁻¹⁶

However, there are still variables that have been little explored in Brazilian literature, such as frailty²⁰ and other comorbidities. There are also no studies on the subject for the northern region of Minas Gerais. This region is characterized as a transition area between the southeast and the northeast of the country, with social indicators that demonstrate major socio-economic needs. Local studies may be representative for other regions of the country. The present study aimed to assess the prevalence of the occurrence of falls and associated factors among the elderly, investigating as yet unexplored variables in a population-based sample of non-institutionalized elderly persons in a regional hub city in the north of Minas Gerais.

METHODS

A cross-sectional and analytical study of non-institutionalized elderly living in the city of Montes Claros, northern Minas Gerais, was conducted. The city has a population of approximately 400,000 inhabitants and is the main regional urban hub.

Sampling was probabilistic by cluster and performed in two stages. In the first stage, the census tract was used as the sampling unit, with 42 of the 362 urban census tracts in the city randomly selected. In the second stage, the number of households was defined, according to the population density of individuals aged 60 or over. At this stage, more households were allocated in the sectors with the highest number of elderly persons, in order to produce a more representative sample.

The sample calculation considered a total population of 30,790 elderly persons (according to IBGE data), a margin of error of 5%, a confidence level of 95% and a prevalence of 28.5%, as this is the median observed in a systematic review study.¹⁰ As cluster sampling was employed, the identified number was multiplied by a correction factor (deff) of two and 10% was added for possible losses. Thus, the minimum number of persons in the sample size calculation of the study was 682.

Elderly persons who were considered by their caregivers/family members to be unable to answer the questions or those who refused to participate in the study were excluded. Elderly persons who were unable to participate in at least three visits on different days and times, even with prior appointments, were considered losses.

Data collection was carried out in the homes of the elderly persons between May and July 2013. Interviewers, who were graduates in nursing, were trained and a pilot study was developed before the collection of data for analysis. The census tracts were visited clockwise from a predetermined point. The data collection instrument was based on similar population-based studies. The pilot study data, from a specially drawn census tract, was not included in the final analysis.

The independent variables studied were: gender (male vs. female), age (younger than 80 years x 80 years or older), self-reported skin color, marital status (married or civil union x without partner), family income (greater than one minimum salary x equal to or lower than one minimum salary), self-perceived health (positive x negative), frailty (defined by the Edmonton Frail Scale, which evaluates nine domains with a score from zero to 17 and defines frailty as a score greater than six),²¹ fear of falling (no x yes), presence of chronic comorbidities (hypertension, diabetes mellitus, osteoporosis, arthritis/arthrosis/rheumatism, heart disease, all self-reported – no x yes), polypharmacy (defined as the continuous use of five or more drugs – no x yes), hospitalization in the last year (no x yes), depressive symptoms (defined by the reduced version of the Yesavage Geriatric Depression Scale - GDS 15, wherein a score equal to or greater than six identifies depressive symptoms),²² functional mobility through the Timed Up and Go test (where a time equal to or greater than 20 seconds

is suggestive of more difficult mobility for the elderly)²³ and smoking (no x yes). All the variables were dichotomized for data analysis.

The prevalence of falls in the previous 12 months was taken as the outcome variable. Initially, bivariate associations were established between the record of falls and the variables using the chi-squared test. In a second step, variables that were associated to a level of 20% ($p < 0.20$) were jointly evaluated by logistic regression. At this stage, the odds ratio was calculated (OR) with respective confidence intervals of 95%, to evaluate the magnitude of associations, assuming a significance level of 5% ($p < 0.05$). Analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 17.0 (SPSS for Windows, Chicago, USA) program.

All the participants were fully informed about the research and gave their consent by signing a Free and Informed Consent Form or by a digital fingerprint record, when unable to sign. The research project was approved by the Research Ethics Committee of the Universidade Estadual de Montes Claros (Montes Claros State University) (Process n° 173397).

RESULTS

The study included 683 predominantly female elderly persons, aged between 60 and 98 years, with a mean of 70.9 years ($SD \pm 8.08$). Most described their skin color as brown (57.1%). There was a predominance of married elderly persons (48.6%). Among the respondents, most reported having up to four years of study, and 26.1% had no schooling. These and other features of the group are presented in Table 1.

Table 1. Sociodemographic characteristics of elderly persons in Montes Claros, Minas Gerais, 2013.

Variables	n	%
Gender		
Female	443	64.9
Male	240	35.1
Age		
60 to 69 years	340	49.8
70 to 79 years	237	34.7
More than 80 years	106	15.5
Skin color/Ethnic Background		
Brown/Mixed Race	390	57.1
Black/Afro-Brazilian	65	9.5
White/Caucasian	214	31.3
Yellow/Asian Brazilian	14	2
Marital Status		
Single	45	6.6
Married	332	48.6
Stable Union	18	2.6
Divorced/separated	54	7.9
Widowed	234	34.3
Family income*		
≤ 1 minimum wage	195	28.6
1 to 2 minimum wages	227	33.2
> 2 minimum wages	261	38.2
Personal income through retirement		
Yes	431	63.1
No	252	36.9
Religion		
Catholic	474	69.4
Evangelical Protestant	192	28.1
Other	4	0.6
None	13	1.9
Practice religion		
Yes	559	81.8
No	124	18.2

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Continuation of Table 1

Variables	n	%
Educational level		
Never studied	178	26.1
1 to 4 years	343	50.2
> 4 years	162	23.7
Living arrangement		
Live alone	82	12.0
Live only with partner	119	17.4
Live with other family members	479	70.1
Live with non-family members	3	0.4

* Minimum wage at time of study (2013) = R\$ 678.00

In relation to health and healthcare, described in Table 2, the majority of respondents said the public system was the most used type of service (68.8%). Health was perceived as good or very good was cited by 291 people (42.6%). About a quarter of respondents (23.6%) reported needing

to use five or more drugs of continuously. During the approach, 243 elderly persons (35.6%) were classified with some degree of frailty by the Edmonton Scale and 200 (29.3%) had scores suggestive of depression symptoms according to the Geriatric Depression Scale.

Table 2. Characteristics related to health care and health conditions among elderly persons in Montes Claros, Minas Gerais, 2013.

Variables	n	%
Type of health service most used		
Public (SUS)	470	68.8
Private	28	4.1
Healthcare plan	120	17.6
Couldn't say	65	9.5
Possess healthcare plan		
Yes	232	34.0
No	451	66.0
Use of five or more medications		
Yes	161	23.6
No	522	76.4

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Continuation of Table 2

Variables	n	%
Has caregiver		
Yes	117	17.1
No	566	82.9
Self-perceived health		
Very good or good	291	42.6
Reasonable	302	35.4
Poor or very poor	90	13.2
Smoking		
Never smoked	382	55.9
Has smoked	242	35.4
Smoker	59	8.6
Analysis of Frailty (Edmonton Frail Scale)		
Frail	243	35.6
Vulnerable	152	22.2
Not frail	288	42.2
Depressive symptoms (GDS-15)		
Yes	200	29.3
No	483	70.7
Hospitalization in previous 12 months		
Yes	121	17.7
No	562	82.3
Comorbidity reported*		
Yes	580	84.9
No	103	15.1
Fear of falls		
Yes	490	71.7
No	193	28.3
Timed Up and Go Test		
< 20 seconds	587	85.9
≥ 20 seconds	96	14.1

* Self-reported hypertension, diabetes mellitus, osteoporosis, arthritis/arthrosis/rheumatism, heart disease were evaluated.

For this sample, the prevalence of falls in the previous 12 months prior to the survey was 28.3%, with most individuals suffering a single fall in this period. The main reported cause was slipping/tripping and most fallers reported needing help to get up (Table 3).

Table 4 presents the results of the bivariate analysis between falls and the main variables. For space limitations, not all the associations investigated are shown.

Table 3. Characteristics linked to falls and postural instability of elderly persons in Montes Claros, Minas Gerais, 2013*.

Variables	n	%
Number of falls in previous 12 months		
One	85	44.0
Two to four	81	42.0
Five or more	27	14.0
Cause of falls		
Tripped/slipped	147	76.2
Loss of consciousness	22	11.4
No apparent reason	24	12.4
Help required in getting up after fall		
Yes	101	52.3
No	92	47.7
Support needed when walking		
Walks alone	167	86.5
Use of aids (canes, crutches, wheelchairs)	26	13.5
Fear of falls		
Yes	157	81.3
No	36	18.7

* Refers only to number of elderly persons who reported falling in last 12 months (n=194)

Table 4. Bivariate analysis for variables associated with falls in previous 12 months among elderly persons in Montes Claros, Minas Gerais, 2013.

Independent variables	Falls				OR (CI95%)	p-value
	Yes		No			
	(n)	(%)	(n)	(%)		
Gender						< 0.001
Male	50	25.8	190	38.9	1	
Female	144	74.2	299	61.1	1.83 (1.26; 2.65)	
Age						0.020
< 80 years	154	79.4	423	86.5	1	
≥ 80 years	40	20.6	66	13.5	1.66 (1.08; 2.57)	
Marital situation						
Married/Stable Union	84	43.3	266	54.4	1	0.009
Lived Alone	110	56.7	223	45.6	1.56 (1.12; 2.18)	
Income						0.654
> 1 minimum wage	141	72.7	347	71.0	1	
≤ 1 minimum wage	53	27.3	142	29.0	0.92 (0.63; 1.33)	
Self-perceived health*						< 0.001
Positive	60	30.9	230	47.0	1	
Negative	134	69.1	259	53.0	1.98(1.39; 2.82)	
Frailty scale						< 0.001
Not frail	50	25.8	238	51.3	1	
Frail/Vulnerable	144	74.2	251	48.7	2.73 (1.89; 3.94)	
Fear of falls						< 0.001
No	36	18.6	157	32.1	1	
Yes	158	81.4	332	67.9	2.08 (1.38; 3.12)	
Osteoporosis**						0.005
No	121	66.5	371	77.4	1	
Yes	61	33.5	108	22.6	1.73 (1.19; 2.52)	
Hypertension**						0.221
No	49	25.3	148	30.3	1	
Yes	145	74.7	340	69.7	1.28 (0.88; 1.88)	
Diabetes Mellitus**						0.176
No	144	74.2	384	79.0	1	
Yes	50	25.8	102	21.0	1.31 (0.89;1.93)	

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Continuation of Table 4

Independent variables	Falls				OR (CI95%)	p-value
	Yes		No			
	(n)	(%)	(n)	(%)		
Cardiac disease**						0.051
No	134	70.2	373	77.7	1	
Yes	57	29.8	107	22.3	1.48 (1.02;2.16)	
Arthritis /rheumatism / arthrosis**						< 0.001
No	99	52.7	331	68.7	1	
Yes	89	47.3	151	31.3	1.97 (1.39; 2.78)	
Polypharmacy						< 0.001
No	130	67.0	392	80.2	1	
Yes	64	33.0	97	19.8	1.99 (1.37; 2.89)	
Hospitalization in previous year						< 0.001
No	145	74.7	428	87.5	1	
Yes	49	25.3	61	12.5	2.37 (1.56;3.61)	
Depressive symptoms						0.029
No	125	64.4	358	73.2	1	
Yes	69	35.6	131	26.8	1.50 (1.06; 2.15)	
Timed Up and Go Test						< 0.001
< 20 seconds	152	78.4	435	89.0	1	
≥ 20 seconds	42	21.6	54	11.0	2.23 (1.43; 3.47)	
Smoking						0.040
Never smoked	121	62.4	261	53.4	1	
Smoker/ex-smoker	73	37.6	228	46.6	0.69 (0.49; 0.97)	

* The categories regular/poor/very poor were considered as a negative self-perception of health. ** Incomplete information was excluded (patients that did not know about disease)

Table 5 shows the variables in the final model, after multivariate analysis. Female gender, a negative self-perception of health, functional mobility impairment (Timed Up and Go test ≥20

seconds), record of hospitalization in the previous 12 months and frailty according to the Edmonton Frail Scale were associated with the occurrence of falls in the previous 12 months.

Table 5. Variables associated with the occurrence of falls among elderly persons in Montes Claros, Minas Gerais, 2013.

Independent Variables	OR (CI95%)	P
Gender		0.011
Male	1	
Female	1.67 (1.13; 2.47)	
Self-perception of health		0.040
Positive (Very good/Good)	1	
Negative (Regular/Poor/Very Poor)	1.49 (1.02; 2.20)	
Frailty scale		0.011
Not frail	1	
Frail/vulnerable	1.73 (1.14; 2.64)	
Timed Up and Go Test		0.046
< 20 seconds	1	
≥ 20 seconds	1.66 (1.02; 2.74)	
Hospitalization in previous year		0.008
No	1	
Yes	1.82 (1.17; 2.84)	

DISCUSSION

The prevalence of falls in the previous 12 months reported by the elderly persons in the present study was very close to that revealed by a Brazilian study which sampled 100 municipalities in 23 states.¹¹ Other Brazilian studies have reported a higher prevalence of falls among the elderly, although these dealt with institutionalized populations.^{13,14} In a review of the topic, the authors observed studies where the prevalence ranged from 15.9% to 56.3%, although it should be noted that this broad range included samples limited to the institutionalized population and larger studies with a population-based analysis.¹⁰

Among the sociodemographic variables, only the female gender was associated with falls. This result has been observed by other authors.^{11-13,16,18} There are no specific explanations for this finding, but other authors have highlighted characteristics specific to women such as reduced muscle strength

and muscle mass and a higher prevalence of degenerative chronic diseases.^{11,24} It is worth noting that one study found that the female gender is also associated with recurrent falls.¹⁷

As for the variable of hospitalization in the year preceding the survey, which was also present in the final model, the risk of falls was greater among elderly persons who had been hospitalized at least once. It was not possible in the present study to verify whether these hospitalizations were directly related to falls or not. However, it can be inferred that this apparent association may be either because a fall is a cause for hospitalization, or as a serious indicator of morbidity and frailty. In this case, immobility, the medications used or the underlying disease, when present, could predispose the individual to falls. Although the association between falls and hospitalizations is common,^{24,25} the association between records of hospitalization in the previous year and the occurrence of falls was observed in one Brazilian

study, which addressed the occurrence of falls in institutionalized elderly persons.⁵ This finding should be further investigated in future research.

A negative perception of health (classified here as "regular", "poor" or "very poor") was also revealed to be associated with a greater chance of falls. The same association was found in other studies.¹⁴⁻¹⁶ It is possible that the indicator is closely related to difficulties with balance.¹⁴ Self-rated health is considered an important health indicator, and is widely used in research and health surveys due to its easy applicability and low cost, compared to other more complex methods. It is a subjective health measure, but reflects the presence of diseases and their impact on the quality of life of individuals.²⁶ In Brazil, the development of further research in this area is desirable, according to a recent review on the subject.²⁷

The impairment of functional mobility as measured by the Timed Up and Go test was also associated with the occurrence of falls in the present study. This result has also been recorded in other studies.^{14,28} The test is simple to perform and can quickly identify disorders in balance and mobility. It is therefore an essential aspect of geriatric evaluation.²³ It is imperative, therefore, that this test is routinely implemented in assessments of older people, in order to identify situations of risk and anticipate specific advice and care.

The greater incidence of falls in elder persons with some degree of frailty has been little investigated in Brazilian literature. Only one study conducted in São Paulo recorded a positive association between the variables, with the authors highlighting the possibility of a two-way relationship – in other words, that falls can make elderly persons frail and frailty can cause elderly persons to fall.²⁰ Literature from outside Brazil shows this association more frequently, although there is no standardization of studies on how to assess frailty.^{29,30} In the present study, analysis of the studied population by the Edmonton Frail Scale confirmed the association between falls and frailty. This scale is a culturally-adapted instrument validated for the Portuguese language which evaluates nine domains (cognition, health, functional independence, social support, medication, nutrition, mood, urinary continence

and functional performance), and is considered a robust instrument due to its multidimensional character.^{21,31}

Other variables identified in literature as associated with the occurrence of falls in the elderly were not identified in this study. Some studies investigated morbidities, for example, which revealed an association in bivariate analysis but did not remain in the final model. An association with osteoporosis, arthritis/arthrosis/rheumatism and falls was identified in another study.¹⁷ It is natural to assume that such conditions lead to uncomfortable situations, with increased sensitivity and stiffness, among other symptoms, contributing to decreased physical ability, affecting mobility and leading to falls. However, these authors did not evaluate functional mobility or frailty, aspects which may include the aforementioned morbidities, in joint multivariate analysis.

The identification of fear of falling as a variable associated with the occurrence of falls in some studies^{9,32} was also not maintained in the final model of the present study. It should be noted, however, that such studies involved a small sample, a fact that may explain the difference observed. Still, we must emphasize that fear of falling is a common profile among the elderly and can make older people feel less confident in performing their daily activities, increasing immobility and postural instability.³³

The present study did not find a relationship between the presence of depressive symptoms/depression and the occurrence of falls, unlike other Brazilian^{13,17} and non-Brazilian^{34,35} studies. This is an important relationship and deserves greater attention from researchers and practitioners. There is not always enough information in studies about the prior exclusion of elderly patients using antidepressant medication, an aspect that can affect comparisons between studies.

This study has some significant limitations, such as the fact that the data was obtained from the responses of respondents. Moreover, the consequences of the falls were not included, which could further contribute to defining the impact on health of the elderly in the region, justifying

more emphatically the need for intervention and more effective prevention measures. Environmental aspects related to falls, such as the characteristics of the site of the fall or the circumstances associated with the event, were not investigated. Also, although there were few losses and refusals relating to participation, the fact that some elderly persons were not at home restricts the more general interpretation of the data. However, it should be emphasized that the study featured a large sample, allowing knowledge to be obtained of a health issue for the elderly that had not been studied in the region.

CONCLUSION

The study found that falls are a common event among elderly persons living in the community in the north of Minas Gerais. Knowledge of associated variables can contribute to the implementation of more effective preventive measures, as such variables are at least partly subject to intervention. Changes in these factors may decrease the risk of falling and its consequences. To achieve this, comprehensive and multidisciplinary care of the elderly is required.

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