Original Article

FACTORS RELATED TO FALLS AMONG ELDERLY WOMEN RESIDENT IN A COMMUNITY

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ABSTRACT

OBJECTIVE. To determine the factors related to falls of a group of independent and autonomous elderly women.

METHODS. This was a descriptive study of 83 elderly women enrolled on the Elderly Health Promotion Project at the *Universidade Católica de Brasília*. They replied to questionnaires on their age, sociodemographic factors, dizziness, use of continuous medication, self-perception of health and vision and underwent the Yesavage Geriatric Depression Scale, Functional Reach Test and Tinetti Performance-Oriented Mobility Assessment.

RESULTS. No statistical relationship was identified between age, social demographic factors, dizziness, or negative self-perception of health and vision and fall phenomena. However there was a significant statistical relationship with the Functional Reach Test and Tinetti Performance-Oriented Mobility Assessment.

CONCLUSION. Elderly women's ability to balance was the major factor related to fall events. Functional Reach Test and Tinetti Performance-Oriented Mobility Assessment were considered effective for predicting risk of falling, indicating that they could be used for assessment and identification of improved balance after training.

KEY WORDS: Accidental falls. External causes. Elderly. Women.

INTRODUCTION

Elderly people currently account for 8.6% of the Brazilian population, and it is estimated that by 2025 they will make up 14%, on the basis of annual growth rates.[9] It is therefore constantly necessary to understand the aging process, in order to guarantee good quality of life for elderly people.

Levels of functional independence and autonomy are currently considered to be the true indicators of elderly people's health status, whether or not diseases or injuries are present.[7] In this context, postural instability, characterized by palpable difficulties with balance, is of great importance in the elderly because it is directly related to falls and is a potential cause of dependence, whether because of physical sequelae or emotional problems. Fear of falling is a major limiting factor of functional independence in the elderly.[7]

Tinetti[23] (2003) reports that more than a third of people aged 65 or older fall every year worldwide, and that in one half of cases falls are recurrent. The author states that falls are responsible for approximately 10% of hospital emergencies and 6% or urgent hospital admissions and is associated with restricted mobility, reduced capacity to engage in daily activities and a growing risk of institutionalization.

The ability to maintain balance reduces as aging progresses, which may be a result of changes inherent to the process. A fall may be the first indication of a failure in the nervous or musculoskeletal systems, which may represent a process of physical deterioration leading to fragility and predisposition to a fatal event.[20]

Causes of falls among elderly people are classified into two major groups: extrinsic causes, those related to environmental obstacles which elderly people cannot cope with, or on social risk situations; and intrinsic causes, that spring from physiological changes related to aging, disease or drugs.[15,23]

Many factors related to the occurrence of falls have been investigated, including those linked with sociodemographic conditions[17] and age[14,2] and health-related factors such as dizziness,[21] psychotropic drugs,[23] self-perceived poor health or vision[17] and depression.[18]

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Identifying the factors associated with falls among the elderly can contribute to elucidating causal phenomena, making it possible to develop timely preventative measures, whether for individuals or for the elderly population as a group.[17]

The objective of this study was therefore to identify factors associated with falls in a group of independent and autonomous elderly women de women, analyzing sociodemographic data, prevalence of dizziness, use of psychotropic drugs, self-perception of health, subjective self-perception of sight, prevalence of depression and scores on two balance tests.

Methods

Initially, the medical records of elderly patients participating in a project entitled "Promoting Health Among the Elderly" were reviewed and 154 women who met the study inclusion criteria were invited to take part.

It was only possible to contact 151 women by telephone. During the telephone conversation the study was explained to the patient who was invited to attend a preliminary consultation. Since 31 of them did not wish to take part and a further 28 did not attend the appointment that had been made for them, a total of 92 elderly women presented at the clinic. However, nine of these 92 women were excluded during the consultation because it emerged that they did not in fact meet the inclusion criteria. The final study sample was 83 elderly women living in the community.

The inclusion criteria were: female sex; age greater than or equal to 60; availability to take part, documented by signature of a free and informed consent form; independence and autonomy to carry out basic daily activities; independence and autonomy to carry out instrumental daily activities; able to walk without the aid of ortheses or other aids.

The exclusion criteria were neurological disease or sequelae impacting on the capacity to balance; orthopedic diseases with symptomology including joint pain that impact on daily activities or independent walking; sequelae from traumas that compromise the ability to balance or to walk; blindness or severely impaired sight that impacts on the ability to walk independently; dependency to perform any daily activity, including mobility within the community and moderate or severe arterial hypertension at enrollment.[24]

At the consultation, the 83 elderly women signed free and informed consent forms and the Portuguese versions of the Katz Index of Independence in Activities of Daily Living[10] and the Lawton Instrumental Activities of Daily Living Scale[12] were administered in order to assess their independence and autonomy.

They then replied to a questionnaire on sociodemographic data, presence or absence of dizziness, continuous-use medications and self-perception of health and sight in addition to the short form of the Yesavage Geriatric Depression Scale (15 items),[19] the Functional Reach Test[3] and the Tinetti Gait and Balance Test.[22]

The self-perception of health scale was administered according to the *Stanford Patient Education Research Center*[8] model and the self-perception of sight scale was constructed according to the same model.

The short form of the Geriatric Depression Scale[32] was administered, as validated in 2005 by Paradela et al.,[16].

The Functional Reach Test was administered according to the model developed by Duncan et al.[3] (1990) to measure forward reach.

The Gait and Balance Test was administered in accordance with the Tinetti model[22] (1986), which was translated into Portuguese and validated in Brazil by Gomes[5] (2003).

Statistical analysis was as follows. Student's *t* test for independent samples was used to compare variables between groups of patients who had and had not fallen during the previous year and the Mann-Whitney test was used when variables did not meet the criteria for normal distribution. Nominal data were analyzed using the chi-square test for proportions. Variables with normal distribution are expressed as means ± standard deviations and other variables are expressed as medians with interquartile ranges.

Multivariate logistic regression was used to investigate the relative risk of associations with the outcome of a fall during the previous year, constructing the model by including variables that were significantly associated with the outcome.

A clinical algorithm to predict the 1-year likelihood of a fall was constructed from possible combinations of values for the variables Functional Reach Test and the Gait and Balance Test. These variables were evaluated by constructing sensitivity curves as functions of specificity (*receiver operating characteristic* - ROC*)* in order to determine the best cutoff point, defined as the point that best discriminates between presence and absence of the outcome.

The pre-test 1-year probability of falling was assumed to be 30%, according to prevalence rates reported in other studies.[22,17]

Findings were considered statistically significant when two-tailed tests of association indicated p values below 0.05. The statistical software employed was *SPSS* for *Windows®* version 13.0.

This study was approved by the Research Ethics Committee at the *Universidade Católica de Brasília*.

Results

All 83 elderly women scored maximum on the Katz et al.[10] (1970) and Lawton and Brody[12] (1969) indexes and were therefore defined as independent and autonomous. Fifty-one point eight percent of them (n=43) reported having suffered a fall during the previous year.

When factors potentially related to falls investigated, no statistical significance was observed for age, complaint of dizziness, exercise, use of psychotropic drugs, participation in group activities, receiving a pension or maintenance allowance, employment, monthly income, educational level, marital status, living with a partner, geriatric depression scale score, self-perception of health or self-perception of sight.

Table 1 lists the relationships between the results for the Functional Reach Test, Tinetti scale, Geriatric Depression Scale, Self-perception of Health and Self-perception of Sight and falls during the previous year.

In this sample of elderly women, scores on the Functional Reach Test and the Gait and Balance Test were significant and low scores on the functional reach test and Tinetti scale could

be related with the occurrence of falls. Therefore, the factor that appears to be the bets predictor of falls in this population is their ability to balance their bodies.

Table 2 illustrates the logistic regression model, showing the odds ratios at a 95% confidence interval and where 14.5% of variation in the outcome fall during the previous year could be explained by the variables "Functional reach" and "Tinetti scale". The odds ratios of 0.86 for the Functional Reach Test and 0.71 for the Tinetti scale, i.e. ratios of less than 1,which means that a good score in any of these tests can be considered to be a protective factor against falls.

On the basis of the significance of the results for the diagnostic accuracy of these two tests, an algorithm (Figure 1) was constructed to predict the 1-year probability of a fall among the elderly on the basis of the results of these two tests.

DISCUSSION

According to Chu et al.[1] (2007), who investigated relationships between falls and factors associated with falling, age clearly exhibited a statistically significant relationship with falling, with older people falling more often. Maciel and Guerra[14] (2005) also found an association between poor balance and age over 75 years in a sample of 310 elderly people over 60. In our study, the ages of the elderly women studied, with means of 70.2 and 68.7 years, respectively for those who had fallen during the previous year and those who had not, may have affected the results. Only four women were 80 or older. According to the literature, the incidence of falls is greater amongst the very elderly, i.e. people aged 80 or more fall more than people aged from 60 to 79.[2] Although the complaint of dizziness is traditionally associated

Table 1 - Results of tests, for women who did and did not suffer falls during the previous year

| Tests	Fell during previous year		p
	Yes (n = 43)	No (n = 40)	
Functional reach	20.7 ± 6.0	23.5 ± 5.0	0.03
Tinetti scale	22 (20-24)	24.5 (22-25)	0.004
Geriatric Depression Scale	5 (3-7)	4 (2-6.5)	0.06
Self-perception of Sight Scale	4 (3-5)	3 (3-5)	0.46
Self-perception of Health Scale	4 (3-4)	3 (2.5-4)	0.43

Source: Authors of this study

Table 2 - Logistic regression model showing odds ratios obtained from standardized regression coefficients with a 95% confidence interval

Functional reach	Tinetti scale	Nagelkerke R^2	P
0.86 (0.79-0.95)	0.71 (0.59-0.87)	14.5%	0.009

Source: Authors of this study

Figure 1- Algorithm for predicting likelihood of falling
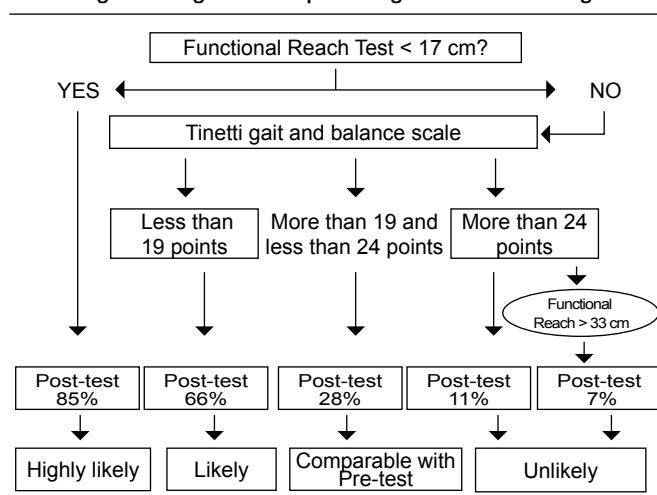
with falls, in our study there was only a tendency towards a relationship between the two factors, without statistical significance. It is possible that these elderly women avoid situations that trigger dizziness and instability, or possibly those that do suffer dizziness may be exposing themselves to risk less, which would reduce the incidence of falls and affect the results.

Tinetti et al.[21] conducted a 1-year study of 1087 elderly individuals aged 72 or over and living in the community with the objective of determining the rate of adverse events in chronic dizziness sufferers, observing a significant association between this symptom and falls, poor self-perception of health, depressive symptoms and social isolation.

None of the sociodemographic factors investigated had statistical significance as a predictor of falls among elderly women. However, other studies have associated factors such as living alone, low educational level, participation in group activities, retirement and use of psychotropic drugs with the phenomenon of falling.[17,14] Low educational level was identified as a risk factor for

hip fracture in a group of 5630 elderly individuals aged 70 or older and living in the community who were followed-up for 2 years.[25]

Maciel and Guerra[14] (2005) also found a relationship between educational level and poor balance. They state that education may be reflected in other important features of a person's life, such as where they live, their cultural level, income and health, and that it is probable that better-educated people will be more concerned with their health, will have a greater capacity to participate in their own healthcare and will have better hygiene. Better educational level is also probably related to increased commitment to preventative health education programs.[14]

Use of psychotropic drugs has been identified before as a risk factor for falls among elderly individuals. Guimarães and Farinatti[6] (2005) found an association between use of psycho-active medications medication and risk of falling among elderly women, and these medications can cause postural hypotension, sedation, arrhythmia, trembling and weakness. Lawlor et al.[11] found a relationship between use of hypnotic, anxiolytic, and antidepressants and falls. This means that there is a need to rethink the treatment of psychiatric problems among elderly individuals, considering the risk-benefit profile of each drug, especially in the most vulnerable populations, such as the very elderly, women, particularly weak people and those who find it difficult to manage daily activities, including mobility. The absence of any relationship between psychotropics and falls in our study may be because a large proportion of the elderly women in our sample were not taking these types of drugs.

In our study the mean Geriatric Depression Scale score did not attain statistical significance as a predictive factor of falls. However, in common with the factor symptoms of dizziness, it did exhibit a tendency towards a relationship and it is possible that in a larger sample it would attain statistical significance. It should be borne in mind that this is a subjective test. The literature reports a relationship between depression and falls, which can be related to loss of functional independence, loss of physical fitness, reduced gait velocity and loss of muscle strength due to immobility and lethargy, which are common in depression.[18]

The results for self-perception of sight and self-perception of poor health also contradict reports in the literature, since these factors had no statistically significant relationship with falls. Perracini and Ramos[17] (2002) found a relationship between self-reported poor or very poor vision and recurrent falls, which were attributed to the impact of defective vision on elderly people's daily performance. Self-perception of poor health was associated with the prevalence of poor balance in elderly people in a study by Maciel and Guerra[14] (2005) and with increased risk of death in a study by Swift[20] (2001).

In the sample of 83 elderly women studied here, the quality of static and dynamic balance, as expressed by the results of the Functional Reach Test and the Gait and Balance Test, was the most relevant factor for estimating the risk of falling and the level of protection against falls in the group of women studied. The data observed confirm the validity of these tests for detecting the risk of falling among elderly individuals resident in the community.

According to the literature, 15 centimeters or less on the Functional Reach Test indicates a significant increase in the risk of falls.[3] In this study reach shorter than 17 cm was associated with a 13 times greater chance of falling.

A score of less than 19 on the Gait and Balance Test has been considered to be a predictor of a high risk of falling.[22] In this study, scores below 19, which were observed in 16% of the elderly women who had fallen, was related with a greater likelihood of falling.

As reported in a study by Figueiredo et al.,[4] the Tinetti scale can be c considered a good predictor of falls in the elderly. These authors report that a combination of four items related with balance (sitting down unaided, inability to stand on one leg, instability turning and instability when the sternum is pushed backwards [nudge test]) and three items related with gait (increased oscillation of the torso, increased diversion of direction and velocity) predict the occurrence of falls. They state that the Functional Reach Test of advantages such as speed and practicality of application and also that elderly people can improve their dynamic balance through training and influence future test results.

It should be pointed out that, despite the high specificity of these two tests, in combination they are still only able to predict 14.5% of fall events, because of the multidimensional character of the phenomenon, since the risk of falling can be influenced by socioeconomic, cultural and demographic factors as well as by factors linked to the person's individual health, as has been shown in the literature.[17,14] Therefore, the results observed here may indicate a protective factor rather than a true risk factor of falling, meaning that good scores on these tests could be considered protective factors against falls while low scores can predict around 14.5% of the possibility of a fall event.

The risk of falling is dependent upon how and in what conditions a given elderly person lives or is living at the time of the fall, and both intrinsic and extrinsic risk factors exert an effect. For example, a person may have functional reach shorter than 17cm, but may not actually be exposed to this risk if already living in an environment that has been adapted to these limitations. In another example, a person might score well on the Gait and Balance Test, but may be living alone and in an inappropriate environment and be exposed to more chances of a fall or recurrent falls, due to the increased exposure to risk.

It is also important to mention that the greater part of falls occur at home, whether inside or outside (in the garden), in bathrooms or kitchens (probably due to extrinsic factors such as slippery floors), during attempts to reach the bathroom quickly (due to frequent urination or incontinence).[13] Poor ambient lighting is also cited as a factor that increases the level of risk. As a result the rate of falls increases at night and among people with poor eyesight.[23]

It can therefore be concluded that, due to the multidimensional nature of falling, preventative interventions must also be multidimensional, involving trained professionals who can have an impact on exposure to both intrinsic and extrinsic factors. The Functional Reach Test and the Gait and Balance Test can be used to predict an elderly person's likelihood of suffering a fall through analysis of their balance and can also be used to assess the parameter of improved motor function after training.

Undeniably, the characteristics of the sample studied here, such as the age of the majority of these elderly women and the total number of participants in the study may have interfered with the results. It is sugge4sted that further research be conducted

using larger samples sizes with the objective of confirming which factors are related to falls among elderly women, since the majority of studies have investigated the relationship in mixed-sex samples.

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