Risk Factors for Fall in Elderly Patients: Follow-Up Study after Hospital Discharge

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Abstract

Introduction: Increased occurrences of falls after discharge are reported, especially in elderly people. Falls are a major cause of disability and identification of risk factors associated with falls is required to plan preventive actions. This study aims to determine the occurrence of falls in the three months after discharge and risk factors in elderly patients. **Materials and Methods:** 100 patients over 65 admitted to an Internal Medicine Ward participated. Questionnaires were given during hospitalization and three months after discharge. Follow-up information was unavailable for 31 patients (25 deceased, 6 unreachable). **Results:** Of those analyzed 52% were males with 80 ± 8.1 years (mean ± SD). Polymedication (p = 0.002), use of psychoactive drugs (p = 0.007), analgesics (p = 0.034) and walking devices (p = 0.006) were associated with a higher incidence of falls 6 months before hospitalization. Post-discharge follow-up was obtained for 69 patients: 18 reported falling during the follow-up. There was a higher risk of fall in patients with a history of falls in the 6 months before admission (p = 0.015 RR = 2.76). Patients who had one or more falls after discharge had a significantly shorter length of hospital stay compared to those who didn't fall (p = 0.012). In multivariate logistic regression, we found that patients who were hospitalized more than 7 days had a lower risk of falling in the post-discharge period (OR = 0.195, p = 0.017) independently of the history of falls 6 months prior to admission. **Conclusions:** Further studies are required to validate the risk factors identified after discharge and to evaluate preventive measures. Elderly patients discharged from an Internal Medicine Ward should be screened to determine the risk of falls, specifically previous history of falls and medication. These patients should integrate a fall prevention program.

1. Introduction

The progress of science and the development of health systems have conditioned a technological and scientific evolution in such a way that the average life expectancy has undergone substantial growth worldwide. It is estimated that the number of elderly people will increase exponentially in Europe over the next 30 years [1]. Longevity can pose a problem with different effects, placing the elderly in a position of greater susceptibility. Among those problems, the occurrence of falls is a major health issue.

The World Health Organization defines a fall as an unintentional displacement of the body to a level lower than the initial position, caused by multi factorial circumstances, resulting in injury or not [2].

A fall consists usually in an involuntary and unexpected event, which may be recurrent in the same individual and often entail consequences for the victim, the caregiver and the society.

Hendrich *et al.* (2003) classified these events into three groups: accidental falls—associated with environmental hazards (obstacles and physical barriers); physiologically predictable falls (individuals with physiological changes predisposing them to a high risk of falling); and physiologically unpredictable falls (although also related to psychological factors, are not predictable before the first fall) [3].

Approximately 28% to 35% of people over 65 living in the community report falling each year, increasing from 32% to 42% in individuals over 70 years [4].

The frequency of falls is even greater in elderly patients after hospitalization [5]. Up to 40% of patients experience an episode within six months after hospital discharge corresponding to 15% of rehospitalization during the same period [6]. In such cases, falls tend to be more severe when compared to the rest of the aging population [7].

The falls result from a complex interaction of multiple risk factors: biological, behavioral, environmental and socioeconomic factors.

About 20% to 30% of falls result in minor injuries, being the underlying cause of 10% to 15% of all consultations in emergency rooms and more than 50% of hospitalizations in the elderly population. 50% of those who fell, will fall again within one year [8].

Besides the physical consequences, falls also have a psychological and social impact. Bradley (2011) stated that 10% of falls result in major injuries such as fractures or traumatic brain injury (TBI) and that hip fractures are the result of nearly 1% of all falls. Nevertheless, on the other hand, it's important to mention that 90% of hip fractures are caused by a fall. This has serious implications in the elderly regarding life expectancy and future disability. The same author states

that the 1-year mortality after hip fractures approaches 25%, and of those surviving, only half regain their baseline ability to perform their activities of daily living (ADL) [9]. Ribeiro, Souza *et al.* (2008), pointed out that 88.5% of the elderly are afraid of falling after a previous fall. The fear of falling or "post-fall syndrome" puts the elderly in a disabling situation due to loss of functional autonomy, social restraint, increased fragility, anxiety and depression. The greater the number of previous falls, the greater the fear of falling again, which usually leads to a restriction of the elderly's daily activities, altogether increasing the likelihood of occurrence of a new event [10].

Knowledge of the incidence, risk factors, circumstances and consequences of falls is critical for their prevention and for the development of follow-up strategies, especially during and after hospitalization, promoting well-being in favor of an active aging.

This study aims to evaluate the incidence of falls in an elderly population, in the first three months after discharge from an Internal Medicine Department of a University Hospital, as well as their risk factors, consequences and circumstances.

2. Materials and Methods

In this prospective study, the first 100 patients admitted to the Internal Medicine Ward of the University Hospital of Coimbra between May and June 2015, were included. The inclusion criteria were: age 65 years or more with no cognitive deficits including aphasia, nor psychiatric illnesses that would prevent their participation in the study.

A questionnaire was conducted during the period of hospitalization where the following information and clinical variables were collected: gender, age, onset diagnosis, personal history (acute or chronic alcoholism, visual problems, neurological diseases—(focusing on previous stroke and parkinsonism), cardiac insufficiency, hypertension, vestibular disorders, musculoskeletal degenerative diseases) and usual medication. Patients were also questioned about the occurrence of falls in the last six months (number, severity and circumstances), and autonomy in ADL (activities of daily living), assessed through the Barthel Index (Mahoney & Barthel, 1965) [11]. The risk of fall during hospitalization was assessed by applying the Morse Scale, depression was screened using the Portuguese version of the "Geriatric Depression Scale" and the Mini-Exam of Mental State was used to track possible cognitive impairment [12] [13] [14].

At the time of discharge, each patient received a diary so that the patient could record the possible falls, timing, circumstances (causes, location) and severity.

Three months after discharge, a telephone interview was conducted and the data reported in the fall diaries were questioned.

Information was collected regarding the discharge destination (community without caregiver, community with caregiver or institution) as well as its characteristics (urban or rural environment and the presence or absence of architectural barriers)., Patients were asked about their current medication, with great

attention paid to psychoactive medication. It was not possible to obtain the information of 31 of the 100 initially included patients (31%): 25% were deceased and 6 did not answer the phone call after 3 attempts on different days and times.

The analysis of the collected data was performed using the SPSS, version 24, assuming the value of p < 0.05 as statistically significant. The continuous variables were compared by using the Mann-Whitney test. The categorical variables were compared using the chi-square test. Variables with a statistically significant difference were later included in a multivariate logistic regression model, whenever applicable.

3. Results

The participants' demographic characteristics in the study are shown in Figure 1. Initially, we analyzed 100 patients, 52% (n = 52) male and 48% (n = 48) female. Age ranged from 65 to 90 years (80 ± 8.1 years - mean ± SD).

The most frequent diagnoses were respiratory (33%), urinary (18%) and cardiac diseases (17%). The mean length of hospital stay was 12.40 ± 14.91 days (mean ± SD).

Table 1 shows the risk factors studied in the first meeting with patients. Polymedication (n = 82; 82%), visual problems (n = 67; 67%), degenerative osteoarthritis (n = 57; 57%) and cardiac insufficiency (n = 51; 51%) were the most prevalent.

According to the Barthel Index most patients (86%) were independent or had only slight dependence. According to the Morse scale, 26% of inpatients were at high risk of falling at admission, while 64% were at low risk. About 77% of patients, after GDS, were in a state of depression or suggestive of depression. The majority (55%) did not show cognitive deficits.

Thirty-six patients evaluated at admission, (58.3% women and 41.7% men, with a mean age of 79.75 ± 8.5 years) experienced at least one episode of fall in the six months prior to hospitalization, and the majority (55.6%) showed more than 1 episode. Of these, 66.7% showed visual deficits and degenerative osteoarthritis, 97.2% were polymedicated (>4 different medications) and 80.6% were medicated with antihypertensive drugs.

However, only polymedication (p = 0.002), the use of psychoactive drugs (p = 0.007) and analgesics (p = 0.034) were associated with a statistically significant higher incidence of falls in the six months before hospitalization.

Most individuals reported loss of strength (36.1%) and impaired balance (33.2%) as the main reasons for falling.

Regarding the use of mobility support devices, 63.9% reported requiring its use: 25% used crutches and 22.2% walking sticks. Users of mobility support devices were more likely to have a fall in the 6 months prior to admission compared to non-users (p = 0.006).

Follow-up information was obtained in 69 patients (Table 2). Six were not reachable, after three attempts at different days and times, while 25 were deceased. Of the patients interviewed by telephone (69%), 52.2% (n = 36) were

male, with a mean age of 79.1 ± 8.7 years.

As for the prescribed medication after discharge, 33.3% of patients were medicated with psychoactive medication (benzodiazepines, antipsychotics or antidepressants), which does not significantly differ from that observed at the onset of hospitalization (25%). Data regarding patient falls within three months after admission can be found in Table 3.

72.5% of the patients were discharged to the community with caregivers, 17.6% to the community without caregivers and 9.9% to an institution. The presence of architectonic barriers and mobility impairments were highlighted by 39.2% (Table 4).

Eighteen individuals, 61.1% female and 38.9% male with a mean age of 76.83 ± 9.0 years, had at least one episode of fall after 3 months of hospital discharge. Impaired balance (33.3%), dizziness (33.3%) and loss of strength (22.4%) were reported as the main causes. Regarding their consequences, 9.2% of the individuals had minor injuries with no need for care, while 4.3% required hospitalization. The majority presented only 1 fall (66.7%) while 5.5% had 3 falls. Most patients (94.4%) lived in community with or without caregiver, mainly in countryside (73.3%).

Patients with a history of fall in the 6 months prior to hospitalization (66.7%) had a higher risk of falling in the three months post-discharge (p = 0.015, RR = 2.76).

As shown in Table 2, patients who had one or more falls after discharge had a significantly shorter length of hospital stay compared to those who didn't fall (p = 0.012). In order to further clarify the association between days of hospitalization and risk of fall, an analysis was performed splitting the study population by median duration of hospitalization (7 days), which showed that patients who were hospitalized more than 7 days had a lower risk of falling in the post-discharge period (OR = 0.195, p = 0.017) independently of the history of falls 6 months prior to admission (Table 5).
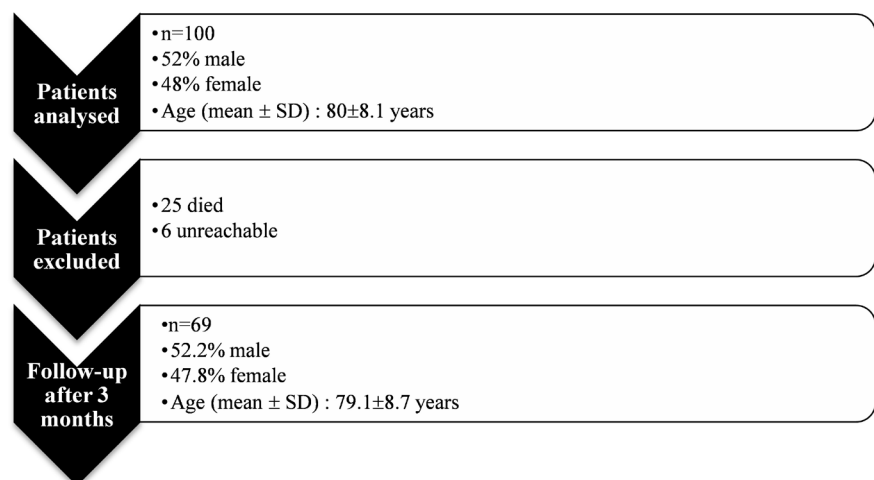

Figure 1. Demographic characteristics of the study participants.

Table 1. Risk factors identified in the interview during hospitalization.

Risk Factors of Falls	Before hospitalization			
Variable	Total (n = 100)	0 fall (n = 64)	≥1 fall (n = 36)	P value
Age (mean ± SD)	80 ± 8.1	78.72 ± 7.82	79.75 ± 8.50	N.S
Gender				
Male	52.0%	57.8%	41.7%	N.S
Female	48.0%	42.2%	58.3%	
Length of Hospital Stay (mean ± SD)	12.40 ± 14.91	11.72 ± 12.65	13.58 ± 18.56	N.S
Admission Diagnosis				N.S
Respiratory pathology (p.)	33.0%	31.3%	36.1%	
Urinary p.	18.0%	18.8%	16.7%	
Cardiac p.	17.0%	9.9%	25%	
Endocrinological p.	7.0%	8.4%	5.4%	
Osteoarticular p.	7.0%	5.4%	8.4%	
Tumour p.	6.0%	7.8%	2.8%	
Gastric p.	5.0%	7.7%	2.8%	
Infectious p.	4.0%	5.1%	2.8%	
Neurological p.	2.0%	2.4%	-	
Hematologic p.	1.0%	1.6%	-	
Dermatological p.	1.0%	1.6%	-	
Previous History				
Alcoholism	9.0%	10.9%	5.6%	N.S
Ophtalmologic changes	67.0%	67.2%	66.7%	N.S
Stroke/VCA	13.0%	10.9%	16.7%	N.S
Cardiac insufficiency	51.0%	51.6%	50.0%	N.S
Parkinson's disease	6.0%	7.8%	2.8%	N.S
Osteodegenerative diseases	57.0%	51.6%	66.7%	N.S
Vestibular changes	16.0%	14.1%	19.4%	N.S
Arterial Hypertension	15.0%	14.1%	16.7%	N.S
Chronic Medication				N.S
Polymedication (>4 drugs)	82.0%	73.5%	97.2%	0.002
Antihypertensive	79.0%	78.1%	80.6%	N.S
Analgesics	26.0%	18.8%	38.9%	0.034
Non-steroidal anti-inflammatory drugs	17.0%	15.6%	19.4%	N.S
Psychoactive drugs	25.0%	29.7%	41.7%	0.007
Walking Devices				
None	58.0%	70.3%	36.1%	
Walking stick	18.0%	14.1%	22.2%	
Crutch	17.0%	14.1%	25.0%	0.006
Tripod	4.0%	-	11.1%	
Wheelchair	2.0%	1.6%	2.8%	
Third-party support	1.0%	-	2.8%	
Barthel Index				
Independence	49.0%	32.8%	47.1%	
Light dependence	37.0%	51.7%	41.7%	N.S
Moderete addiction	9.0%	3.2%	11.2%	
Severe addiction	3.0%	9.5%	-	
Total dependency	2.0%	2.8%	-	
More Scale				
High risk	26.0%	18.6%	39.0%	
Low risk	64.0%	68.9%	55.4%	
Without risk	10.0%	12.5%	5.6%	N.S
Geriatric Depression Scale				
Depression	44.0%	47.3%	38.9%	
Suggested depression	33.0%	37.6%	27.8%	N.S
No changes	23.0%	15.1%	33.3%	
Mini Mental State Exam				
Cognitive deficit	45.0%	46.9%	41.7%	
No cognitive deficit	55.0%	53.1%	58.3%	N.S

Table 2. Risk factors identified 3 months after discharge.

Risk Factors of Falls	Within 3 months of discharge		
Variable	0 fall (n = 51)	≥1 fall (n = 18)	P value
Age (mean ± SD)	79.96 ± 8.56	76.83 ± 9.0	N.S
Gender			
Male	51.0%	38.9%	N.S
Female	49.0%	61.1%	
Length of Hospital Stay			
(mean ± SD)	11.71 ± 15.69	6.72 ± 6.78	0.012
Previous History			
Alcoholism			
Ophtalmologic changes	9.8%	5.6%	N.S
Stroke/VCA	75.6%	55.6%	N.S
Cardiac insufficiency	11.8%	11.1%	N.S
Parkinson's disease	51.9%	44.4%	N.S
Osteodegenerative diseases	9.8%	-	N.S
Vestibular changes	51.9%	61.1%	N.S
Arterial Hypertension	4%	22.2%	N.S
Chronic Medication	11.7%	27.8%	N.S
Polymedication (>4 drugs)			
Antihypertensive	86.3%	94.4%	0.002
Analgesics			
Non-steroidal	86.3%	77.8%	N.S
Anti-inflammatory drugs	21.6%	44.4%	0.034
Psychoactive drugs	15.7%	22.2%	N.S
Walking Devices	29.4%	44.4%	0.007
None			
Walking stick	54.9%	50%	0.006
Crutch	17.6%	27.8%	
Tripod	19.6%	11.1%	
Wheelchair	2.0%	11.1%	
Third-party support	3.9%	-	
Barthel Index	2.0%	-	
Independence			
Light dependence	27.5%	50%	N.S
Moderete addiction	56.7%	22%	
Severe addiction	11.8%	22.4%	
Total dependency	2.0%	5.6%	
More Scale	2.0%	-	
High risk			
Low risk	31.4%	49.8%	N.S
Without risk	60.8%	44.6%	
Geriatric Depression Scale	7.8%	5.6%	
Depression			
Suggested depression	25.5%	59.1%	
No changes	37.2%	23.3%	N.S
Mini Mental State Exam	37.3%	17.36%	
Cognitive deficit			
No cognitive deficit	39.2%	50%	N.S
Falls 6 Month Before	60.8%	50%	
hospitalization	33.3%	66.7%	0.015

Table 3. Description of fall episodes that occurred within 6 months before admission and 3 months after discharge.

Falls	6 months before hospitalization (n = 36)	3 months after discharge (n = 18)
Number of Falls		
1	44.4%	66.7%
2	22.2%	27.8%
3	19.5%	5.5%
>3	13.9%	-
Fall Reason		
Pain	5.6%	5.5%
Dizziness	16.7%	33.3%
Lack of strength	36.1%	22.4%
Vertigo	2.8%	5.5%
Lack of Balance	33.2%	33.3%
Poor visual acuity	5.6%	-
Fall Severity		
Without	64.0%	85.5%
Surface injury	25.0%	9.2%
Bone fracture	6.0%	1.0%
Internment need	5.0%	4.3%

Table 4. Description of discharge period.

Discharge Period	Total (n = 100)	≥1 fall after 3 months (n = 18)
Place		
Community on their own	17.6%	22.2%
Community with care giver	72.5%	72.2%
Institution	9.9%	5.6%
Environment of residency		
Urban	33.5%	26.7%
Countryside	66.5%	73.3%
Architectonic barriers		
No	60.8%	44.4%
Yes	39.2%	55.6%

Table 5. Multivariate logistic regression for falls in the 3 months after discharge.

Variable	P value	OR
Falls 6 month before the hospitalization	0.010	5.113
Length of hospital Stay: >7 days	0.017	0.195

4. Discussion

Falls are a result of a multiplicity of factors and, especially in the elderly population, might have a significant impact, since they can easily lead to disability or even death.

The reported frequency of falls in our population (36%) in the six months prior to hospitalization was similar to the numbers found in literature (28% - 35%) [2]. The frequency of falls was higher in patients who used mobility support devices and multiple medications, probably reflecting the impact of comorbidities or polymedication on muscular strength and balance. The frequency of

falls was numerically higher in females; however, this difference was not statistically significant in our sample. Berg *et al.* (1997) identified some variables that might explain this fact, such as the average life expectancy of females, the reduced frequency of outdoor activities, the greater number of medications (namely the use of psychotropic drugs) and the decrease in grip strength [15] [16].

There was a higher frequency of falls in patients using multiple medications (>4 drugs), as well as in patients with regular use of analgesics and psychoactive drugs, which might reflect the impact of the comorbidities or the medication itself. Medication is the most common and potentially reversible risk factor for falls and, as it is pointed in many studies, it's linked to an increase in the risk of fall [17]. Psychotropic drugs may be related to the occurrence of fall due to its sedative, anticholinergic effects and adrenergic block activities. The sedative effect is responsible for psychomotor alterations, whereas the adrenergic block increases the probability of orthostatic hypotension, dizziness, ataxia and confusion [18]. We also observed that the majority of individuals who fell had musculoskeletal degenerative diseases, what might help explain the association between the occurrence of falls and the use of analgesics. Other studies have also shown that the use of four or more drugs was linked to an increased risk of falling. This relationship may result from the adverse interactions between the various drugs, or from the conditions for which they were taken, that is, individuals taking more medication tend to have more comorbidities and are also at a greater risk of falling [19].

Patients who used medical support devices had a higher frequency of fall, what might be explained by baseline mobility issues.

There was a positive correlation between the risk of falling during hospitalization and its occurrence in the last six months. A previous history of fall proved to be a significant risk factor for further falls after discharge.

The immediate period after hospital discharge is most prone to adverse events, including falls. Previous studies have shown that 15% of patients fall within the first three weeks after discharge [6]. In this study, the incidence of falls after discharge was 26.1% in a three months period of follow-up.

Patients with a history of falls during the six months before hospital admission showed twice the risk of falling within three months after discharge. This result is consistent with other studies that showed that previous history of fall is one of the most important risk factors [20]. Individuals who have fallen tend to limit their daily activities owing to fear of new episodes, however, this leads to a decrease in their desire for these tasks, making them more dependent, and, thus, leading to a greater risk of falling.

With the pressure on health care budgets increasing, there has been a decrease in length of hospital stay over the years, so that the transition period of patients after discharge carries a higher risk [21]. This study shows that patients with an inpatient length of stay of less than seven days have an increased risk of falls in

the 3 months after discharge. This might be due to the fact that a shorter hospital stay leads to less time to implement rehabilitation plans, not allowing proper preparation of the individuals to face the risks in the post-discharge period [22]. The screening and identification of risk factors is extremely important in order to optimize the prevention of falls.

Limitations of this study were the small sample size and the fact that the cohort came from one Internal Medicine Department from an University Hospital, conditioning the generalization of our results to other post-discharge populations. Although this was a prospective research, another possible limitation is related with the data collection, done by the patient, not assuring its complete reliability. Multicentric randomized studies are needed to confirm the identified risk factors and to evaluate the effectiveness of preventive measures.

5. Conclusions

This study shows that patients with a history of falls during the six months before hospital admission had twice the risk of falling within 3 months after discharge. In addition, patients with an inpatient time of less than seven days also showed an increased risk of falling in that period.

A holistic evaluation should be done in elderly patients discharged from an Internal Medicine Ward, especially those admitted for a short length of stay, in order to identify risk factors for falls. Integration into a fall prevention program should be considered for high risk patients.

Ethical Consideration

Ethical approval was obtained from appropriate authorities.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Ferrucci, L., Giallauria, F. and Guralnik, J.M. (2008) Epidemiology of Aging. *Radiologic Clinics of North America*, **46**, 643-652.
https://doi.org/10.1016/j.rcl.2008.07.005

[2] World HO (2007) WHO Global Report on Falls Prevention in Older Age. WHO, Geneva.

[3] Hendrich, A.L., Bender, P.S. and Nyhuis, A. (2003) Validation of the Hendrich II Fall Risk Model: A Large Concurrent Case/Control Study of Hospitalized Patients. *Applied Nursing Research*, **16**, 9-21. https://doi.org/10.1053/apnr.2003.016009

[4] Zecevic, A.A., Salmoni, A.W., Speechley, M. and Vandervoort, A.A. (2006) Defining a Fall and Reasons for Falling: Comparisons among the Views of Seniors, Health Care Providers, and the Research Literature. *Gerontologist*, **46**, 367-376.
https://doi.org/10.1093/geront/46.3.367

[5] Hill, A.M., Hoffmann, T., McPhail, S., Beer, C., Hill, K.D., Oliver, D., *et al.* (2011)

Evaluation of the Sustained Effect of Inpatient Falls Prevention Education and Predictors of Falls after Hospital Discharge—Follow-Up to a Randomized Controlled Trial. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, **66**, 1001-1012. https://doi.org/10.1093/gerona/glr085

[6] Mahoney, J.E., Palta, M., Johnson, J., Jalaluddin, M., Gray, S., Park, S., *et al.* (2000) Temporal Association between Hospitalization and Rate of Falls after Discharge. *Archives of Internal Medicine*, **160**, 2788-2795. https://doi.org/10.1001/archinte.160.18.2788

[7] Watson, W.L., Clapperton, A.J. and Mitchell, R.J. (2011) The Cost of Fall-Related Injuries among Older People in NSW, 2006-07. *NSW Public Health Bulletin*, **22**, 55-59. https://doi.org/10.1071/NB10002

[8] Scuffham, P., Chaplin, S. and Legood, R. (2003) Incidence and Costs of Unintentional Falls in Older People in the United Kingdom. *Journal of Epidemiology and Community Health*, **57**, 740-744. https://doi.org/10.1136/jech.57.9.740

[9] Fabricio, S.C., Rodrigues, R.A. and da Costa Jr., M.L. (2004) Falls among Older Adults Seen at a Sao Paulo State Public Hospital: Causes and Consequences. *Revista De Saude Publica*, **38**, 93-99.

[10] Ribeiro, A.P., de Souza, E.R., Atie, S., de Souza, A.C. and Schilithz, A.O. (2008) The Influence of Falls on the Quality of Life of the Aged. *Ciência & Saúde Coletiva*, **13**, 1265-1273. https://doi.org/10.1590/S1413-81232008000400023

[11] Mahoney, F.I. and Barthel, D.W. (1965) Functional Evaluation: The Barthel Index. *Maryland Medicine Journal*, **14**, 61-65.

[12] Yesavage, J.A. (1988) Geriatric Depression Scale. *Psychopharmacology Bulletin*, **24**, 709-711.

[13] Verissimo, M.T. (1988) Avaliação Diagnóstica dos sindromes demenciais: Escala de depressão geriátrica. Serviço de Neurologia do Hospital S João do Porto, Porto.

[14] Guerreiro, M., Silva, A., Botelho, M.A., Leitão, O. and Garcia, C. (1994) Adaptação à população portuguesa na tradução da "Mini Mental State Examination" (MMSE). *Revista Portuguesa de Neurologia*, **1**, 9-10.

[15] Berg, W.P., Alessio, H.M., Mills, E.M. and Tong, C. (1997) Circumstances and Consequences of Falls in Independent Community-Dwelling Older Adults. *Age Ageing*, **26**, 261-268. https://doi.org/10.1093/ageing/26.4.261

[16] Cumming, R.G., Miller, J.P., Kelsey, J.L., Davis, P., Arfken, C.L., Birge, S.J., *et al.* (1991) Medications and Multiple Falls in Elderly People: The St Louis OASIS Study. *Age Ageing*, **20**, 455-461. https://doi.org/10.1093/ageing/20.6.455

[17] Tinetti, M.E. and Kumar, C. (2010) The Patient Who Falls: It's Always a Trade-Off. *JAMA*, **303**, 258-266. https://doi.org/10.1001/jama.2009.2024

[18] Leipzig, R.M., Cumming, R.G. and Tinetti, M.E. (1999) Drugs and Falls in Older People: A Systematic Review and Meta-Analysis: II. Cardiac and Analgesic Drugs. *Journal of the American Geriatrics Society*, **47**, 40-50. https://doi.org/10.1111/j.1532-5415.1999.tb01899.x

[19] Ryynanen, O.P., Kivela, S.L., Honkanen, R., Laippala, P. and Soini, P. (1991) Incidence of Falling Injuries Leading to Medical Treatment in the Elderly. *Public Health*, **105**, 373-386. https://doi.org/10.1016/S0033-3506(05)80597-9

[20] Davenport, R.D., Vaidean, G.D., Jones, C.B., Chandler, A.M., Kessler, L.A., Mion, L.C., *et al.* (2009) Falls Following Discharge after an In-Hospital Fall. *BMC Geriatrics*, **9**, 53. https://doi.org/10.1186/1471-2318-9-53

[21] Clarke, A. and Rosen, R. (2001) Length of Stay. How Short Should Hospital Care

Be? *European Journal of Public Health*, **11**, 166-170.
https://doi.org/10.1093/eurpub/11.2.166

[22] Nordstrom, P., Gustafson, Y., Michaelsson, K. and Nordstrom, A. (2015) Length of Hospital Stay after Hip Fracture and Short Term Risk of Death after Discharge: A Total Cohort Study in Sweden. *BMJ*, **350**, h696. https://doi.org/10.1136/bmj.h696