Original Article

RISK FACTORS FOR FALLS IN THE ELDERLY*

FATORES DE RISCO PARA QUEDAS EM IDOSOS

FACTORES DE RIESGO PARA CAÍDAS EN ANCIANOS

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The occurrence of falls represents an obstacle in the health of the elderly, and it contributes to increase their dependence. This study aimed to investigate the intrinsic and extrinsic risk factors, and possible statistical associations for falls in elderly people in the last six months. A case-control study with quantitative approach developed in three Rehabilitation Associations and one Social Assistance Center, with two groups with thirty participants each, a group with falls (case) and another group without falls (control). The data were collected from January to April 2010 by a form, and were organized is spreadsheets and analyzed by a statistical program. The case group presented worst intrinsic conditions and more extrinsic factors. Feet alterations, impaired balance and proprioceptive deficit were highlighted among the intrinsic risk factors that were statistically significant. The conclusion is the reinforcement of multifactorial hypothesis for falls occurrence with possibilities for nurse's performance.
Descriptors: Accidental Falls; Risk Factors; Aged; Nursing.

A ocorrência de quedas representa um obstáculo na saúde dos idosos e contribui para aumentar a dependência. O estudo teve o objetivo de investigar os fatores de risco intrínsecos e extrínsecos, além de possíveis associações estatísticas para quedas em idosos nos últimos seis meses. Estudo tipo caso-controle, com abordagem quantitativa, desenvolvido em três Associações de Reabilitação e um Centro de Assistência Social, com dois grupos com trinta idosos cada, um grupo com queda (caso) e outro sem queda (controle). Os dados foram coletados de janeiro a abril de 2010, através de formulário. Os dados foram organizados em planilhas e analisados por programa estatístico. O grupo caso apresentou piores condições intrínsecas e mais fatores extrínsecos. Dentre os fatores de risco intrínsecos estatisticamente significativos, destacam-se: alterações nos pés, equilíbrio prejudicado e alterações proprioceptivas. Conclui-se pelo reforço da hipótese multicausal para ocorrência das quedas, com possibilidades para atuação do enfermeiro.
Descritores: Acidentes por Quedas; Fatores de Risco; Idoso; Enfermagem.

La ocurrencia de caídas representa obstáculo en la salud de ancianos y aumenta su dependencia. El objetivo fue investigar los factores de riesgos intrínsecos y extrínsecos, además de posibles asociaciones estadísticas para caídas en ancianos en los últimos seis meses. Estudio caso-control con enfoque cuantitativo, desarrollado en tres Asociaciones de Rehabilitación y un Centro de Asistencia Social, con dos grupos con treinta ancianos cada, un grupo con caídas (caso) y otro sin caídas (control). Datos recogidos de enero hasta abril de 2010, por formulario. Los datos fueron organizados en plantillas y analizados por programa estadístico. El grupo caso presentó peores condiciones intrínsecas y más factores extrínsecos. Entre los factores de riesgo intrínsecos estadísticamente significativos, se señalan: alteraciones en los pies, equilibrio perjudicado y alteraciones propioceptivas. Por el refuerzo de la hipótesis de *multicausalidad* para ocurrencia de caídas, la posibilidad de actuación del enfermero.
Descriptores: Accidentes por Caídas; Factores de Riesgo; Anciano; Enfermería.

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INTRODUCTION

Falls are the leading external cause of hospitalization in Brazil, affecting about 300,000 people. Among the group of diseases due to external causes, falls have the highest hospitalizations rates among females (42.39%) and elderly people (57.85%)[1]. The incidence of falls tends to increase, given the growth of the elderly population due to increased life expectancy. Moreover, falls become a concern especially in the elderly aged over 80 years due to the possible injuries derived from them[2].

Being old can enable the occurrence of several factors, which in turn may increase the risk of falling, such as: osteoporosis, sensorimotor changes like postural instability, decreased flexibility and mobility, muscle weakness, abnormal gait and balance, visual impairments, hearing impairments, cognitive decline, depression, and polypharmacy. Furthermore, potentially crippling diseases, such as stroke (cerebrovascular accident), are also more common in the elderly and tend to aggravate the physiological problems that contribute to an increased risk of falling[3].

Thus, the aging process can increase the individual's possibility of falling, who consequently become dependent to perform activities of daily living[4].

It is worth mentioning that the risk conditions that lead to the fall event may be multifactorial and involve intrinsic and extrinsic conditions. Intrinsic factors are defined as those arising from physiological changes related to advancing age[2]. On the other hand, extrinsic factors are related to unsafe environments, poorly designed and constructed, with architectural barriers, presence of stairs, lack of differentiation of steps and handrails, poor lighting, loose rugs, obstacles in the circulation area (for example, wires and poorly maintained floors)[2].

Early and correct identification of the main risk factors for falls leads to the possibility of preventing these injuries. By identifying risks efficiently, we can prevent complications resulting from falling, such as the need for health interventions and increased physical dependence, besides the financial burden to the health care system[5].

Therefore, we aimed to answer the following question: what are the main risk factors for falls in elderly people who have had or not this event in the last six months? Thus, the present study aimed to investigate the intrinsic and extrinsic risk factors for falls in the elderly and check for possible statistical associations between the groups with and without reported falls in the last six months.

METHODS

This was a case-control study with the occurrence of falls as outcome variable. The study was conducted in three Rehabilitation Associations that treat elderly patients who had a stroke, and one Social Assistance Center that conducts weekly social activities with a group of elderly people.

Participants were grouped into two categories, each with 30 seniors, which were matched for age, sex and stroke incidence, given this event can result in significant physical changes. Because of insufficient records of the units in study, the sample could not be estimated in advance. Thus, there was no sample size calculation and we established the following inclusion criteria for both the case and control group: be registered and attend the activities of the institutions in study, and be aged 60 or older. For the case group was necessary to have experienced an episode of falling in the last six months, while for those who composed the control group, it was necessary not to have experienced an episode of falling in the last six months. The following exclusion criteria were established: the elderly who did not present conditions of standing, aphasia, complete blindness or cognitive impairment characterized by the inability to understand a command and establish verbal communication.

Data were collected from January to April 2010, on

the occasion of the elderly attendance to the research sites to perform their usual activities. Data collection was performed by two nurses and six nursing students trained to fill out the instrument, as well as apply the tests and scales. We used an instrument that aimed to characterize the patient's socio-demographic data, besides the information based on the intrinsic and extrinsic risk factors of the Nursing Diagnosis Risk for Falls proposed by NANDA-I[6].

Thus, we investigated the following intrinsic factors: weight and height to calculate the body mass index[7]; lower limb strength, tested by the assessment of individual's ability to flex or extend the members against the resistance[7]; feet conditions observed through inspection and palpation[7]; proprioception condition, gait, balance and risk for falls, besides functional capacity assessment, degree of dependence verification, visual and cognitive acuity, and depression conditions[8].

These variables were measured with the aid of six instruments recommended by national manuals directed to the elderly[2,8], namely: Tinetti gait and balance examination, Barthel index, activities of daily living, Snellen chart, mini-mental state examination, and geriatric depression scale.

Following, we questioned the occurrence of falls in the past six months, and in affirmative cases we investigated the extrinsic factors, such as excess of furniture in the place; absence of anti-slip material in the bathroom; poor lighting; unfamiliar room; and rugs scattered on the floor. These factors were mentioned according to the respondents' perception.

Data were organized in Microsoft Excel® spreadsheets and statistically analyzed using SPSS software, version 19.0, with a significance level adopted of 5%. For analysis of dichotomous variables of matched groups, we performed the McNemar's test, also using mean and standard deviation values to assist in the analysis and interpretation of data. We also applied the Wilcoxon test for the data that did not follow a normal distribution, proceeding to the analysis of measures of central tendency and dispersion, such as means and interquartile range.

In compliance with Resolution 196/96 of the National Health Council regarding researches involving humans, the study was submitted to and evaluated by the Research Ethics Committee of the Universidade Federal do Ceará, and approved under Protocol No. 314/09. Additionally, the participants were informed of the research objectives and secured on the commitments regarding anonymity and voluntary participation, requesting the consent by signing the Free and Informed Consent Form.

RESULTS

Each group was composed of thirty elderly, fifteen of which had experienced a stroke episode. Most participants were female (66.7%), with a mean age ranging from 69.8 to 71 years. Next, in Table 1, we present the distribution of participants according to socio-demographic variables.

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Table 1 - Distribution of participants with falls (case group) and without falls (control group) according to socio-demographic variables (N=60). Fortaleza-CE, Brazil, 2010

Variables	Group with falls (n=30)			Group without falls (n=30)			McNemar's test
With partner	13	(43.3%)		17	(56.6%)		0.424
Without partner	17	(56.6%)		13	(43.3%)		
Retired	28	(93.3%)		27	(90%)		1.000
Household activity	2	(6.6%)		3	(10%)		
Alone	3	(10%)		5	(16.6%)		0.687
With relatives	27	(90%)		25	(83.3%)		
	Mean (SD[1])	25P[2]	75P[3]	Mean (SD[1])	25P[2]	75P[3]	Wilcoxon test
Per capita income R$	400.1(±311)	181.7	510.0	506.2(±380)	255.0	545.0	0.284
Education (years)	4.6 (4.0)	1.75	6.25	5 (3.5)	2	6.25	0.777

[1] Standard deviation; [2] 25th percentile; [3] 75th percentile.

By grouping the participants regarding the presence or absence of falls, we verified that individuals who reported falling were those who in most cases did not have a partner, were retired and lived with relatives, besides having lower household income and lower education than those that did not report falling. As for the statistical analysis of these socio-demographic data, it was not possible to identify significantly relevant results. Data related to risk factors for falls are shown below in Table 2.

Table 2 - Characterization of groups according to intrinsic and extrinsic risk factors for falls (N=60). Fortaleza-CE, Brazil, 2010.

Variables	Case Group (n=30)		Control Group (n=30)	
Moderate dependence*	14	(46.6%)	7	(23.3%)
Mild dependence*	8	(26.6%)	9	(30%)
Independence*	8	(26.6%)	12	(40%)
Partial dependence**	18	(60%)	15	(50%)
Independence**	12	(40%)	15	(50%)
Normal BMI∞	12	(40%)	11	(36.6%)
Overweight BMI∞	14	(46.6%)	13	(43.3%)
Obesity I BMI∞	4	(13.3%)	4	(13.3%)
Absence of depression	20	(66.6%)	23	(76.6%)
Mild depression	10	(33.3%)	7	(23.3%)
Cognitive deficit Ω	8	(26.6%)	11	(36.6%)
Risk for falls†	9	(30%)	5	(16.6%)
Reduced LL strength‡	16	(53.3%)	16	(53.3%)
Decreased visual acuity§	24	(80%)	19	(63.3%)
Excess of furniture at home	10	(33.3%)	6	(20%)
Unfamiliar house	9	(30%)	8	(26.6%)
Absence of anti-slip material in the athroom	18	(60%)	11	(36.6%)

* Barthel index;** Instrumental activities of daily living; ∞ Body mass index; Ω Mini-mental state examination; † Tinetti gait and balance examination; ‡ Lower limbs; § Snellen chart

In general, elderly people who reported falling in the past six months had worst performance on individual criteria, such as increased dependence, overweight, depression, increased risk for falls, and decreased visual acuity.

As regards to extrinsic risk factors addressed in this study, no participant reported using non-slip material in the bathroom shower, specifically. With the exception of the risk condition "Unfamiliar room" reported only by one volunteer from each group, the other environmental risk

factors were more frequently found in the group with falls.

On the analysis of intrinsic and extrinsic risk factors for falls in these two elderly groups, when grouped according to the occurrence of falls, we observed statistically significant associations, as shown in Table 3.

Table 3 - Distribution of groups according to the intrinsic and extrinsic risk factors statistically more relevant to the occurrence of falls (n=60). Fortaleza-CE, Brazil, 2010.

Variables	Case Group (n=30)		Control Group (n=30)		McNemar's
Changes in feet	11	(36.6%)	4	(13.3%)	0.021
Proprioceptive deficit	14	(46.6%)	6	(20%)	0.057
Impaired balance	16	(53.3%)	9	(30%)	0.092

As stated, we found few statistical correlations significantly relevant. It is also important mentioning that all correlations evidenced referred to individual conditions. Of these, the existence of changes in the feet, such as calluses, ingrown toenails or deformities, were more distinct between the groups, besides statistically significant (p=0.021). Problems such as proprioceptive deficits and impaired balance also proved higher in patients with falls; however, these variables did not present statistically significant results. The other numeric variables, such as BMI, handgrip strength, Barthel index, IADL or Tinetti gait and balance examination, when investigated in these two groups, did not show statistically significant results, not even near the level of significance adopted.

DISCUSSION

The characterization of the groups was similar to another study that also approached the occurrence of falls, which found the prevalence of females, with low household income and low education among those who presented the Nursing Diagnosis Risk for falls[9].

As regard to the group of elderly patients with history of falls, this was generally the group that presented the worst intrinsic conditions, results also confirmed by other authors, who report the occurrence of falls being more present among those individuals with physical disabilities[10-13]. In this context, we highlight, for example: the difficulty in performing activities of daily living, with low scores on the Barthel Index and increased functional dependence of the elderly[10]; visual impairment that often contributes to the elderly not being able to avoid obstacles[11-12]; overweight and body mass index out of the normal standards can influence an uneven physical structure and greater than the body can support, thus compromising the balance[13]; and finally the depression condition that increases the chances of falling, since such health problems have many risk factors in common[14].

The extrinsic risk factors were also more noticeable in the group of elderly patients with history of falling, a similar finding to another study[12], which, in turn, emphasizes the high expenses that falling costs to the public coffers, as well as implications for the quality of life of the elderly, a fact that leads to the need for greater attention to reducing environmental barriers.

It is worth mentioning the statistical association found on the existence of changes in feet. Foot deformities, presence of calluses, hallux valgus, claw fingers, flat feet or edema are examples of these changes and may cause functional limitations of gait and thus contribute to the occurrence of falls[15].

Consequently, abnormalities that affect the feet also interfere with balance and gait. Feet are responsible for supporting the body when it is standing (static function) and serve as a lever for the act of walking (kinetic function). Also in the case of several foot deformities, the use of inappropriate footwear, such as high heels or too-

tight shoes, seems to have a decisive contribution[2].

The changes in feet of patients are considered risk factors for the occurrence of falls, which should be continuously evaluated[16]. According to the above, the risk factor Changes in feet was the one that presented the most significant statistical association in this study (p=0.021).

In this study, the proprioceptive deficit variable, which comprises the triad of balance information, presented the most relevant statistical association when comparing the groups of thirty elderly regarding the occurrence of falls, being close to the level of statistical significance.

Proprioceptors supply the body with information about the immediate environment, allowing the organism to guide itself as it moves or stands upright with regard to its own body parts, support and soil surface. Given the deprivation of a system like the proprioceptive, it is possible to compensate for it by other systems. However, if more than one system is affected, it may decrease the falling threshold[17].

Thus, the body balance is maintained by the cooperation of the muscles and joints of the body (proprioceptive system), the eyes (visual system), and the labyrinth (vestibular system). These areas send their balance information to the brain for coordination and perception in the cerebral cortex[8]. For this reason, these systems must be perfectly synchronized in order to achieve the most possible uniform balance.

As for the impaired balance, this is a prevalent issue among the elderly. By submitting the elderly to a higher demand condition, the postural control obtained worse rates compared to younger individuals. These results reinforce that deficiency in maintaining the postural stability is associated with aging[17].

We also highlight that changes in static and dynamic postural balance interfere with functional ability of elderly living in the community, and can be a significant risk factor

for falls, thus influencing the quality of life of this population. The impaired balance also contributes to increased risk for falls, as found by applying the Tinetti gait and balance examination, which also shows that the intrinsic factors are still the most identified with the fall event[9].

In this context, knowing the most present risk factors, especially in clients who had a stroke in the rehabilitation phase, allows nurses to promote activities that stimulate a healthier lifestyle and prevent complications[18]. Thus, the professional can act seeking to correctly and quickly identify the risk factors involved and propose preventive actions aimed to educate, guide and empower the individual and family as protagonists of health actions[9].

The study limitations, in turn, are based on the type of study population, which added the characteristic of attending some health service or social life, which might represent a greater interest of these people concerning the search for improvement or maintenance of health conditions. It is also worth mentioning the fact that the intrinsic conditions assessed in the research could differ from those actually presented on the day of the fall, as well as the extrinsic conditions could be more reliably assessed through home visits and not just based on the elderly's report, given that some present some memory deficit.

CONCLUSION

The intrinsic or individual risk factors, such as changes in feet, impaired balance and proprioceptive deficits, were the most relevant in the context of falling, by presenting a higher statistical significance. It is noteworthy that these factors constitute an interrelated system, in which the change in one of them can directly affect the other, decreasing the falling threshold as a system responsible for maintaining the body balance and support.

Thus, the few statistical associations found suggest

the following clinical implication: intrinsic risk factors are more associated with the occurrence of falls. However, individuals with history of falling were also those who presented more extrinsic risk factors to the event, which reinforces the hypothesis of multiple causes for the occurrence of falls.

In nursing, it is important to know this perspective, since it is a population with several specific limitations and needs. This enables the development of a more effective nursing care plan, by concentrating efforts and actions in the risk factors known to be more significant. On the other hand, extrinsic factors may be more easily subject to change. Thus, it is also important to evaluate these risk factors by qualified health professionals, aiming to early identify risks and propose strategies to prevent falls. In this way, it is possible to maintain favorable health conditions of the elderly, and contribute to a healthy aging increasingly independent.

We also suggest the achievement of further studies with other specific populations, as well as the longitudinal follow-up of these patients, in order to obtain greater reliability regarding the presence of risk factors.

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