



REVISTA BRASILEIRA DE REUMATOLOGIA

www.reumatologia.com.br



Original article

Falls and their association with physical tests, functional capacity, clinical and demographic factors in patients with rheumatoid arthritis

Mariana de Almeida Lourenço^{a,*}, Izabela Roma^b, Marcos Renato de Assis^b

^a Universidade Estadual Paulista (Unesp), São Paulo, SP, Brazil

^b Faculdade de Medicina de Marília (Famema), Marília, SP, Brazil

ARTICLE INFO

Article history:

Received 25 August 2015

Accepted 3 August 2016

Available online xxx

Keywords:

Rheumatoid arthritis

Accidental falls

Postural balance

Aptitude tests

ABSTRACT

Objective: To evaluate the occurrence of falls reported by rheumatoid arthritis patients and its relation to disease activity, functional capacity and physical fitness.

Materials and methods: A cross-sectional study constituted by a sample of 97 rheumatoid arthritis patients from the city of Marília (SP) from 2012 to 2013, were assessed for disease activity. Instruments validated for Brazilian population in order to evaluate physical and functional capacity were used. Data analysis was carried out with descriptive statistics, Spearman correlation and Chi-squared test, considering $p < 0.05$.

Results: 88.7% were female subjects with a mean age of 56 (± 11.7) years. The median duration of rheumatoid arthritis was 10 years (P25=6 and P75=17) and the mean of disease activity was 3.6 (± 1.3), what was considered a moderate activity. In the last 12 months 37.1% of patients experienced at least one fall, with a total of 52 episodes, and fear of falling was reported by 74.2% of them, but this was not associated to the occurrence of a fall ($\chi^2 = 1.19$, $p = 0.27$). Gender, number of medications, age, disease activity, duration of rheumatoid arthritis, functional capacity, and physical tests showed no associations with history of falls in the past year.

Conclusion: It was observed that the occurrence of falls and the fear of falling are quite common in this population. The occurrence of falls in this sample of rheumatoid arthritis patients bears no relation to disease activity, functional capacity, or physical fitness tests.

© 2016 Elsevier Editora Ltda. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

* Corresponding author.

E-mail: maalmeida1@terra.com.br (M.A. Lourenço).

<http://dx.doi.org/10.1016/j.rbre.2016.09.013>

2255-5021/© 2016 Elsevier Editora Ltda. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Ocorrência de quedas e sua associação com testes físicos, capacidade funcional e aspectos clínicos e demográficos em pacientes com artrite reumatoide

R E S U M O

Palavras-chave:

Artrite reumatoide
Acidentes por quedas
Equilíbrio postural
Testes de aptidão

Objetivo: Avaliar a ocorrência de quedas reportadas por pacientes com artrite reumatoide (AR) e sua associação com a atividade da doença, capacidade funcional e aptidão física.

Material e métodos: Estudo transversal com uma amostra de 97 pacientes com AR em Marília (SP), entre 2012 e 2013. Foram usados instrumentos validados na população brasileira para avaliar capacidade física e funcional. Análise dos dados com estatística descritiva, correlações de Spearman e qui-quadrado, considerado $p < 0,05$.

Resultados: Dos pacientes, 88% eram mulheres, média de 56, anos ($\pm 11,7$), duração mediana da AR de 10 anos (P25 = 6 e P75 = 17) e média da atividade da doença 3,6 ($\pm 1,3$). Nos últimos 12 meses, 37,1% tiveram pelo menos uma queda (total 52 episódios), 74,2% relataram medo de cair, porém sem associação com a ocorrência de quedas ($\chi^2 = 1,19$, $p = 0,27$). Sexo, quantidade de medicamentos, idade, atividade da doença, duração da AR, capacidade funcional e testes físicos não estão associados com história de queda no último ano.

Conclusões: Observou-se que a ocorrência de quedas e o medo de cair é frequente nessa população. A ocorrência de quedas nessa amostra de pacientes com AR não está relacionada à atividade da doença, à capacidade funcional e a testes de aptidão física.

© 2016 Elsevier Editora Ltda. Este é um artigo Open Access sob uma licença CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Rheumatoid arthritis (RA) is a systemic inflammatory, autoimmune, chronic, progressive disease of unknown etiology, which can lead to bone destruction and to deformity.¹⁻³ Patients suffering from RA may have muscle weakness, reduced mobility, postural instability, proprioceptive, postural balance, and gait changes, which are known risk factors for falls.⁴⁻¹⁴

The occurrence of falls has been reported as something between 14.3%⁷ and 54%⁵ in patients with RA. This great range can be explained by the lack of criteria and of standards in the studies, in addition to a few studies involving falls and RA. Some studies in patients with RA have shown an association of falls with higher disease activity, reduced functional capacity, and with physical fitness and balance tests.^{4,5,7-9,11,14-17}

The impact of the falls reaches physical, psychosocial, economic and family aspects. The lesions range from small abrasions to fractures, particularly in osteoporotic bone (a common comorbidity in patients with RA).^{5,7,9,11,15-17} By being a frequent event, the characterization and identification of patients are fundamental, in order to establish specific programs and interventions for its prevention in this population.

In the Brazilian population, we found only one study of Marques et al.¹⁸ on falls in patients with RA, which shows the lack of national studies in order to characterize these patients. In view of this, the aim of this study was to evaluate the occurrence of falls in patients with RA and their relationship to age, disease duration and activity, physical assessment tests, and functional capacity.

Materials and methods

The study was approved by the Human Research Ethics Committee of the Faculdade de Medicina de Marília (FAMEMA) under the Protocol 672/12. All subjects received oral and written explanations and participated in the study after signing the Informed Consent Form.

A cross-section study was performed, with our convenience sample comprising 97 patients of both genders diagnosed with RA, followed in FAMEMA Rheumatology Out-patient Clinic. To calculate the sample size, the following formula¹⁹ was used:

$$\frac{Z_{1-\alpha/2}^2 P(1-P)}{d^2}, \quad \text{where}$$

- $Z_{1-\alpha/2} = 1.96$, for $\alpha = 0.05$ (type I error);
- P = the expected proportion of falls in the RA population, considering 35% (an intermediate value between the extremes of 15% and 55% found in the literature);
- d = a precision of 10%.

The sample size obtained by this formula would be 87 patients; we added 10% to compensate for losses and refusals, totaling 96 patients, but there were no refusals as to the participation in this study.

The inclusion criteria were: (a) a diagnosis of RA according to the American College of Rheumatology (ACR) classification criteria of 1987 or to the classification criteria for RA of 2010 from ACR/EULAR (European League Against Rheumatism)^{1,20,21}; (b) age over 18; (c) physical ability to perform the tests. The exclusion criteria were: (a) a deficit of

comprehension limiting the interview; (b) severe visual or hearing impairment.

Patients were evaluated by a rheumatologist (M.R.A.) to confirm the diagnosis of RA, and at that time measurements of disease activity were carried out. Patients underwent blood sampling performed by a nurse (I.R.), and then were referred to take medical history and a specific interview about falls, as well as to the application of physical tests by a physiotherapist (M.A.L.).

For identification of the falls in the last 12 months, a questionnaire prepared by the researchers was used. The definition adopted for a fall was “an unintentional displacement of the body to a level below the starting position, with the inability of correction in a timely manner, determined by multifactorial circumstances and affecting stability”.²² The questions concerned the occurrence and description of the falls, being considered the last 12 months (quantity, location, reason, the time of occurrence, the activity involved, consequences, and the presence of fear of falling).

To assess disease activity, the Disease Activity Score (DAS-28), which counts joints with pain and swelling in 28 joints, the overall self-assessment of health obtained with the use of a visual analog scale (VAS) from 0 to 100, and the erythrocyte sedimentation rate, given in millimeters per hour (mm/h) through a hemosedimentation technique performed at the Blood Center of FAMEMA.^{23–26}

The Health Assessment Questionnaire (HAQ),^{27,28} validated in Brazil by Ferraz et al.,²⁹ was used to evaluate the functional capacity and the following tests to measure physical capacity: (a) Berg Balance Scale (Berg), proposed by Berg et al. in 1989 and validated in Brazil by Miyamoto,³⁰ which evaluates the balance of the patient in 14 representative situations of his/her daily routine;^{30–32} (b) the “Timed Up and Go” (TUG) test, proposed by Podsiadlo and Richardson in 1991 to evaluate balance in the sitting position, the transfer from a sitting position to a standing position, stability in ambulation, and changes in the gait course without the use of compensatory strategies;^{31,33,34} (c) 6-min Walk Test (6MWT) developed by Balke in 1963 and currently used to evaluate the functional capacity and exercise tolerance;^{35–37} (d) the Guralnik Test Battery or Short Physical Performance Battery (SPPB) developed by Jack M. Guralnik and validated in Brazil by Nakano,³⁸ used to evaluate static balance, walking ability, and the ability to get up from a chair.^{39,40}

Descriptive statistics were performed, with the presentation of central tendency and dispersion measures, according to the nature of the distribution of variables (mean, median, standard deviation, and percentiles) for the characteristics of the sample, description of the falls, and test score values. To check the normality of the data, the Kolmogorov–Smirnov test was applied. As the data were nonparametric, a correlation with the Spearman test for the number of falls and physical, functional and disease activity was carried out. The following values were adopted to interpret the strength of correlations: 0.0–0.3 insignificant; 0.3–0.5 low; 0.5–0.7 moderate; 0.7–0.9 high, and 0.9–1.0 very high.⁴¹ As to the association between groups (fallers and non-fallers) and the variables pharmacologic agents, fear of falling, and gender, the Chi-squared test was used. A significance level of $p < 0.05$ was

adopted and all analyses were performed using the SPSS v. 21 program.

Results

Ninety-seven patients participated in this study; they were mostly women, married, Caucasian subjects showing overweight, according to body mass index (BMI) (Table 1). All patients are in use of at least one pharmacological agent for RA, and 27 (27.8%) are using a disease-modifying drug.

Disease duration ranged from 2 to 40 years with a median of 10 years (P25 = 6 and P75 = 17), characterizing an established disease in the sample studied. The mean for DAS28 was 3.6 (± 1.3), a value related to a disease in moderate activity (> 3.2 and ≤ 5.1).²⁶ The median of HAQ was 0.6 (1st and 3rd quartiles, 0.1–1.5), which indicates a mild to moderate disability.²⁸

In the 12 months preceding the interview, about a third of patients experienced one or more falls, totaling 52 episodes. No patient had 4 or more falls in the past year, and the occurrence of only one episode was the most frequent value during this period. Falls occurred more frequently during the day, at home, as the subject was walking, by stumbling or slipping. In most episodes, the patient did not visit the doctor or the emergency room but suffered some kind of injury/abrasion, or severe pain (Table 2).

Fear of falling was reported by 74.2% of patients, both among those who suffered falling episodes in the previous

Table 1 – Sample characteristics.

Variable	Value
Patients, n	97
Gender, n (%)	
Female	86 (88.7%)
Male	11 (11.3%)
Age (years)	
Mean \pm SD	56.0 \pm 11.7
Minimum–maximum	23–88
Weight (kg)	
Mean \pm SD	68.7 \pm 15.5
Minimum–maximum	34.3–109.2
Height (m)	
Mean \pm SD	1.57 \pm 0.08
Minimum–maximum	1.37–1.78
BMI (kg/m ²)	
Mean \pm SD	27.5 \pm 5.3
Minimum–maximum	15.3–40.0
Medicines (number of)	
Mean \pm SD	4.5 \pm 1.9
Minimum–maximum	1–10
Marital status, n (%)	
Single	17 (17.5%)
Married	61 (62.9%)
Divorced	10 (10.3%)
Widow(er)	9 (9.3%)
Race, n (%)	
White	60 (61.9%)
Brown	25 (25.8%)
Black	12 (12.3%)

SD, standard deviation; kg, kilogram; m, meter; BMI, body mass index; RA, rheumatoid arthritis.

Table 2 – Characterization of the reported falls in the last 12 months.

Variable	n	(%)
<i>Has fallen in the last 12 months</i>		
Yes	37	37.4
No	62	62.6
<i>Number of times the patient has fallen</i>		
1	24	64.9
2	10	27
3	3	8.1
4 or more	0	0
<i>Time of the day in which the fall occurred</i>		
Morning	22	41.5
Afternoon	18	34
Night	12	22.6
Dawn	1	1.9
<i>Place of occurrence of the fall</i>		
At home	29	54.7
In the street	19	35.8
In the workplace	3	5.7
In a leisure environment	2	3.8
<i>Activity developed during the fall</i>		
Walking	33	62.2
Climbing/descending a ladder	9	17
Home care	7	13.2
Get dressed up	2	3.8
Picking up an object	2	3.8
<i>Reason that led to the fall</i>		
Stumbled	20	37.8
Slipped	19	35.8
Leg weakness	6	11.3
Lost balance	5	9.4
Felt dizzy	2	3.8
Foot sprain	1	1.9
<i>Procedures after the fall</i>		
None	35	66.1
Emergency room	13	24.5
Medical appointment	5	9.4
<i>Fall consequences</i>		
Injuries/bruises	18	34
Severe pain	16	30.2
None	14	26.4
Fracture	5	9.4

year and those who did not suffer any fall, but with no significant association ($p=0.274$) with the falls reported in the last 12 months (Table 3). Also, there was no significant association between fear of falling and age ($p=0.289$), disease duration ($p=0.071$) and disease activity ($p=0.082$). Patients with a fear of falling had greater functional impairment measured by the

Table 3 – Results of physical tests TUG, Berg, 6MWT and SPPB.

	Results	Minimum and maximum
Berg (median, P25–P75)	53 (49–56)	15–56
TUG (median, P25–P75)	9.3 (7.7–12.2)	5.5–39.4
SPPB (median, P25–P75)	10 (8–12)	1–12
6MWT (Mean \pm SD)	376.7 \pm 111.9	120–620

Berg, Berg Balance Scale; 6MWT, 6-min walk test (in meters); TUG, Timed Up and Go (in seconds); SPPB, Short Physical Performance Battery; P25, 25th percentile; P75, 75th percentile; SD, standard deviation.

HAQ ($p=0.004$) and a poorer performance on 6MWT ($p=0.002$), TUG ($p=0.007$) and SPPB ($p=0.020$) tests when compared to those who stated that were not afraid of falling.

No significant association was found between the occurrence of falls in the last 12 months and age ($\rho=0.070$, $p=0.498$), disease activity ($\rho=0.050$, $p=0.629$), duration of RA ($\rho=-0.015$, $p=0.888$) and functional capacity ($\rho=0.167$, $p=0.102$). Also, the amount of drugs taken daily and patient gender had no association with the presence of falls in the last year (Table 4).

The worst performance in physical tests was associated with older age, longer disease duration, and increased disease activity. Functional capacity was shown to be moderately associated with performance in all physical tests, indicating that the limitation of functional activities reflects a poorer performance on these tests. There was no association between the numbers of falls with any of the physical performance tests (Table 5).

Discussion

The percentage of people who have suffered falls in a period of 12 months ranged from 14.3%⁷ to 54%⁵ (18.8%,¹⁶ 26.9%,¹⁷ 30.2%,¹⁸ 30.9%,¹⁰ 33%,¹¹ 35.2%,⁸ 36.4%,^{12,14} 37.1%,⁴² 42%,¹³ and 50%⁹). In this study, about 37% of the participants experienced at least one fall in the last 12 months, similar to the 30.2% found in another study on a Brazilian population.¹⁸ This annual incidence is considered high when compared to the estimated incidence for elders over 65 (28–35%), and over 75 (32–42%) years.²²

As was reported by Stanmore et al.,¹² there was a predominance of falls at home, probably because these subjects spend

Table 4 – Associations of reported falls with the number of medications, the presence of fear of falling, and gender.

		Occurrence of falls		χ^2	p
		No (n)	Yes (n)		
Medicines	Up to 3	24	8	3.002	0.083
	4 or more	37	28		
Fear of falling	Yes	43	29	1.199	0.274
	No	18	7		
Gender	Female	55	31	0.370	0.543
	Male	6	5		

χ^2 , Chi-squared test.

Table 5 – Associations between age, duration of RA, DAS28, HAQ and number of falls versus physical performance tests.

	Berg	6MWT	TUG	SPPB
Age	-0.392 ^a	-0.315 ^a	0.322 ^a	-0.335 ^a
Duration of RA	-0.233 ^a	-0.261 ^a	0.160	-0.179
DAS28	-0.420 ^a	-0.286 ^a	0.329 ^a	-0.433 ^a
HAQ	-0.575 ^a	-0.534 ^a	0.546 ^a	-0.687 ^a
Number of falls	-0.141	-0.051	0.072	-0.139

RA, rheumatoid arthritis; DAS28, Disease Activity Score 28; HAQ, Health Assessment Questionnaire; Berg, Berg Balance Scale; 6MWT, 6-min walk test (in meters); TUG, Timed Up and Go (in seconds); SPPB, Short Physical Performance Battery; Age (in years); Duration of RA (in years). Spearman correlation.

^a $p < 0.05$.

most of their time indoors, due to a more limited lifestyle, where the set of physical limitations, functional dependence, and fear force the patient to refrain from work activities, leisure, and social participation. Another explanation is their great familiarity with the home environment, where those existing extrinsic risk factors for the occurrence of falls are underestimated.

In this study, a minority (32.7%) sought some kind of specialized care after the fall; this finding is similar to that observed in the studies by Fessel and Nevitt¹⁰ (31%) and Stanmore et al.¹² (26%). This is perhaps explained by the low severity of these injuries, that indeed were minor lesions, abrasions, and pain, as occurred in the reviewed studies.^{8,10,12}

RA patients are at increased risk of osteoporotic fracture, which results from the interaction between an increased bone fragility (low bone density) and trauma, and the fall is an important causative factor in adults of all ages with RA. We observed a higher incidence (9.6%) of fractures from falls in our patients, when compared to other studies that range from 1.1% to 5%, as well as in the elderly, whose fractures occur in about 5% of falls.^{9,11,16,22}

The fear of falling causes patients to change their behavior, including a decrease in recreational activities.^{8,10} This fear can lead to a cycle in which the patient physically committed by RA goes on to avoid risky situations and becomes less active, which worsens his/her physical capacity and increases the chances of a future fall. No national data was found to quantify the fear of falling among a population with RA; however, we consider the percentage found in our study as being high (74.2%), when compared with the percentage of other countries (20.6%,⁴ 46.2%,¹⁷ 50.5%,¹⁰ 59.8%,⁸ and 66.7%⁷).

According to Duyur Çakat et al.,⁷ patients with fear of falling suffer from the disease for longer periods of time and produce worse scores on the Beck Depression Scale, besides a poorer physical performance. It was found that patients with fear of falling showed worse physical/functional capacity, perhaps because these subjects did not perform the tests at their maximum capacity, which hampers to some extent the results of physical tests.

Regarding the use of pharmacological drugs, no significant difference between the groups of fallers and non-fallers was found, as in the study of Smulders et al.¹³ In the literature reviewed, it was observed that a greater risk of falling is related

to the greater amount of medication that the patient takes (OR = 1.44²⁸), and to the use of antidepressants (OR = 2.09²⁸) and steroids.¹⁴

As in the literature on this subject, although age is a major risk factor, being commonly associated with the presence of falls, this factor is not associated with the occurrence of falls in patients with RA.^{4,7,9-15,17} A possible explanation for this finding is that people with RA (not controlled, or already with their sequels) have risk factors similar to the physiological characteristics of aging, that predispose these subjects to the falls. Thus, these patients show a premature aging, at least from the standpoint of their locomotor system. Among all studies, only that of Bugdayci et al.¹⁶ found an association between age and the occurrence of falls; on the other hand, Schober et al.⁴² found that older age was associated with an increased risk of falls in patients with RA, and some studies point to the need to further investigate the relationship between age and the occurrence of falls in this population.^{14,17}

Regarding the disease duration, the mean of the examined studies was 11–17 years,^{5,7-11,13,15,17} and our median was 10 years. No association was found between disease duration and occurrence of falls in this study ($\rho = -0.015$, $p = 0.888$) as well as in several other studies.^{5,9,11,13,17}

The mean score of disease activity (assessed by DAS28) found in our study, 3.6 (± 1.3), shows a moderate activity, but no association with the occurrence of falls ($\rho = 0.050$, $p = 0.629$). As in Stanmore et al.^{12,14} and in Duyur Çakat et al.⁷ studies, in the group of fallers the score of disease activity is higher versus non-fallers (3.7 and 3.5, respectively). On the other hand, Hayashibara et al.⁹ found no difference in DAS28 between fallers and non-fallers.

As Böhler et al.¹⁷ found, we observed an association between disease activity and performance in physical tests, indicating that patients with higher disease activity may have more difficulty in performing physical tests, thus getting worse results.

In its vast majority, the studied sample shows a mild-to-moderate impairment by HAQ, and there is a moderate association between poor functional score and worst performance in physical tests; but an association with the occurrence of falls could not be demonstrated. According to Marques et al.,¹⁸ functional disability, measured by HAQ, is the main risk factor for falls in Brazilian patients with RA. The literature shows that those patients with higher HAQ scores are at greater risk of falling, suffered a greater number of falls in the last year, have more fear of falling (as was found in our sample), and had a poorer performance on physical tests.^{4,5,7,10,13,14,17}

It was observed in the literature a lack of standardization in the choice of physical tests to evaluate the risk of falls. In this study, validated instruments widely used in Brazil were chosen. There was no association between a previous occurrence of falls and the performance on tests applied to our sample of patients with RA. It can be difficult to identify an association between falls and worse performance in tests of balance and physical performance, because the same factors that lead to functional impairment, which is a potential predisponent to the occurrence of falls, also limit the patient's activities and can reduce his/her exposure to risk situations.

This study has some limitations. Information on the occurrence of falls obtained by self-report tend to be underestimated (recall bias) and many studies suggest that prospective studies are carried out, where the falls are controlled by a calendar of falls and/or by phone calls, and over a longer period of time than one year, as this period may not be sufficient to distinguish between fallers versus non-fallers.^{9,10,12,13,15-17} Some studies^{11,12,14} show that samples from a reference outpatient clinic may not adequately represent the population with RA in general: it is expected that these samples present a greater number of severe cases of RA; but even the most severe cases can be in a good condition, thanks to their access to a good treatment. The fact that we did not consider the level of physical activity of our patients, and the wide age range of the sample, are also limitations to this study.

The occurrence of falls is a complex multifactorial event whose prediction can be difficult, even with the combined use of measures of activity of the disease, functionality, and physical tests. Physical tests were not associated with the occurrence of previous falls, and this suggests that prospective studies are needed in order to assess the ability of these and other instruments as predictive of the occurrence of falls in people with RA.

Conclusions

Our results confirm an increased prevalence of falls in patients with RA; but with no association with age, gender, disease duration and activity, functional capacity, the number of drugs used, and physical fitness tests. Physical tests have shown an association with age, disease duration and activity, and, especially, functional capacity.

Funding

A Master's degree fellowship from Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

Conflicts of interest

The authors declare no conflicts of interest.

REFERENCES

1. Mota LMH, Cruz BA, Brenol CV, Pereira IA, Fronza LSR, Bertolo MB, et al. Consenso da Sociedade Brasileira de Reumatologia 2011 para o diagnóstico e avaliação inicial da artrite reumatoide. *Rev Bras Reumatol.* 2011;51:207-19.
2. Mota LMH, Cruz BA, Brenol CV, Pereira IA, Rezende-Fronza LS, Bertolo MB, et al. Consenso 2012 da Sociedade Brasileira de Reumatologia para o tratamento da artrite reumatoide. *Rev Bras Reumatol.* 2012;52:152-74.
3. Wasserman AM. Diagnosis and management of rheumatoid arthritis. *Am Fam Physician.* 2011;84:1245-52.
4. Furuya T, Yamagiwa K, Ikai T, Inoue E, Taniguchi A, Momohara S, et al. Associated factors for falls and fear of

- falling in Japanese patients with rheumatoid arthritis. *Clin Rheumatol.* 2009;28:1325-30.
5. Kaz Kaz H, Johnson D, Kerry S, Chinappen U, Tweed K, Patel S. Fall-related risk factors and osteoporosis in women with rheumatoid arthritis. *Rheumatology (Oxford).* 2004;43:1267-71.
6. Häkkinen A, Kautiainen H, Hannonen P, Ylinen J, Mäkinen H, Sokka T. Muscle strength, pain, and disease activity explain individual subdimensions of the Health Assessment Questionnaire disability index, especially in women with rheumatoid arthritis. *Ann Rheum Dis.* 2006;65:30-4.
7. Duyur Çakat B, Nacir B, Erdem HR, Karagoz A, Saraçoğlu M. Fear of falling, fall risk, and disability in patients with rheumatoid arthritis. *Turk J Rheumatol.* 2011;26:217-25.
8. Jamison M, Neuberger GB, Miller PA. Correlates of falls and fear of falling among adults with rheumatoid arthritis. *Arthritis Rheum.* 2003;49:673-80.
9. Hayashibara M, Hagino H, Katagiri H, Okano T, Okada J, Teshima R. Incidence and risk factors of falling in ambulatory patients with rheumatoid arthritis: a prospective 1-year study. *Osteoporos Int.* 2010;21:1825-33.
10. Fessel KD, Nevitt MC. Correlates of fear of falling and activity limitation among persons with rheumatoid arthritis. *Arthritis Care Res.* 1997;10:222-8.
11. Armstrong C, Swarbrick CM, Pye SR, O'Neill TW. Occurrence and risk factors for falls in rheumatoid arthritis. *Ann Rheum Dis.* 2005;64:1602-4.
12. Stanmore EK, Oldham J, Skelton DA, O'Neill T, Pilling M, Campbell AJ, et al. Fall incidence and outcomes of falls in a prospective study of adults with rheumatoid arthritis. *Arthritis Care Res.* 2013;65:737-44.
13. Smulders E, Schreven C, Weerdesteyn V, Van den Hoogen FH, Laan R, Van Lankveld W. Fall incidence and fall risk factors in people with rheumatoid arthritis. *Ann Rheum Dis.* 2009;68:1795-6.
14. Stanmore EK, Oldham J, Skelton DA, O'Neill T, Pilling M, Campbell AJ, et al. Risk factors for falls in adults with rheumatoid arthritis: a prospective study. *Arthritis Care Res.* 2013;65:1251-8.
15. Yamagiwa K, Iijima S, Furuya T, Ikai T, Inoue E, Taniguchi A, et al. Incidence of falls and fear of falling in Japanese patients with rheumatoid arthritis. *Mod Rheumatol.* 2011;21:51-6.
16. Bugdayci D, Paker N, Rezvani A, Kesiktas N, Yilmaz O, Sahin M, et al. Frequency and predictors for falls in the ambulatory patients with rheumatoid arthritis: a longitudinal prospective study. *Rheumatol Int.* 2013;33:2523-7.
17. Böhler C, Radner H, Ernst M, Binder A, Stamm T, Aletaha D, et al. Rheumatoid arthritis and falls: the influence of disease activity. *Rheumatology (Oxford).* 2012;51:2051-7.
18. Marques WV, Cruz VA, Rego J, Silva NA. Influência da capacidade funcional no risco de quedas em adultos com artrite reumatoide. *Rev Bras Reumatol.* 2014;54:404-8.
19. Charan J, Biswas T. How to calculate sample size for different study designs in medical research. *Indian J Psychol Med.* 2013;35:121-6.
20. Fuller R. Critério de classificação da artrite reumatoide ACR-Eular 2010 [Editorial]. *Rev Bras Reumatol.* 2010;50:481-6.
21. Aletaha D, Neogi T, Silman AJ, Funovits J, Felson DT, Bingham CO, et al. 2010 Rheumatoid arthritis classification criteria: an American College of Rheumatology/European League Against Rheumatism collaborative initiative. *Arthritis Rheum.* 2010;62:2569-81.
22. Sociedade Brasileira de Geriatria e Gerontologia. Quedas em idosos: prevenção. In: Associação Médica Brasileira, Conselho Federal de Medicina. Projeto Diretrizes; 2008. p. 1-15.
23. Pinheiro G. Instrumentos de medida da atividade da artrite reumatoide: por que e como empregá-los. *Rev Bras Reumatol.* 2007;47:362-5.

24. Mello FM (dissertação) Análise da correlação dos escores de atividade de doença na artrite reumatóide. Florianópolis, SC: Universidade Federal de Santa Catarina; 2008, 66 pp.
25. Prevoo MLL, Van't Hof MA, Kuper HH, Van Leeuwen MA, Van de Putte LBA, Van Riel PLCM. Modified disease activity scores that include twenty-eight-joint counts. Development and validation in a prospective longitudinal study of patients with rheumatoid arthritis. *Arthritis Rheum.* 1995;38:44–8.
26. Aletaha D, Smolen J. The Simplified Disease Activity Index (SDAI) and the Clinical Disease Activity Index (CDAI): a review of their usefulness and validity in rheumatoid arthritis. *Clin Exp Rheumatol.* 2005;23 Suppl. 39:S100–8.
27. Corbacho MI, Dapueño JJ. Avaliação da capacidade funcional e da qualidade de vida de pacientes com artrite reumatóide. *Rev Bras Reumatol.* 2010;50:31–43.
28. Bruce B, Fries JF. The Health Assessment Questionnaire (HAQ). *Clin Exp Rheumatol.* 2005;23 Suppl. 39:S14–8.
29. Ferraz MB, Oliveira LM, Araujo PM, Atra E, Tugwell P. Crosscultural reliability of the physical ability dimension of the health assessment questionnaire. *J Rheumatol.* 1990;17:813–7.
30. Miyamoto ST, Lombardi Junior I, Berg KO, Ramos LR, Natour J. Brazilian version of the Berg balance scale. *Braz J Med Biol Res.* 2004;37:1411–21.
31. Figueiredo KMOB, Lima KC, Guerra RO. Instrumentos de avaliação do equilíbrio corporal em idosos. *Rev Bras Cineantropom Desempenho Humano.* 2007;9:408–13.
32. Resende S, Rassi C, Viana F. Efeitos da hidroterapia na recuperação do equilíbrio e prevenção de quedas em idosos. *Rev Bras Fisioter.* 2008;12:57–63.
33. Shumway-Cook A, Brauer S, Woollacott M. Predicting the probability for falls in community-dwelling older adults using the Timed Up & Go Test. *Phys Ther.* 2000;80:896–903.
34. Guimarães LHCT, Galdino DCA, Martins FLM, Vitorino DFM, Pereira KL, Carvalho EM. Comparação da propensão de quedas entre idosos que praticam atividade física e idosos sedentários. *Neurociências.* 2004;12:68–72.
35. American Thoracic Society. ATS statement: guidelines for the six-minute walk test. *Am J Respir Crit Care Med.* 2002;166:111–7.
36. American College of Rheumatology. Six minute walk test (6 MWT); 2011. Available in: <http://ww2.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp> [accessed 02.05.14].
37. Rondelli RR, Oliveira AN, Dal Corso S, Malaguti C. Uma atualização e proposta de padronização do teste de caminhada de seis minutos. *Fisioter Mov.* 2009;22: 249–59.
38. Nakano MM (dissertação) Versão brasileira da Short Physical Performance Battery (SPPB): adaptação cultural e estudo da confiabilidade. Campinas, SP: Universidade Estadual de Campinas; 2007, 163 pp.
39. Alfieri FM, Riberto M, Gatz LS, Ribeiro CPC, Battistella LR. Uso de testes clínicos para verificação do controle postural em idosos saudáveis submetidos a programas de exercícios físicos. *Acta Fisiatr.* 2010;17:153–8.
40. Uhler CR (dissertação) Análise do controle postural de idosos jovens e idosos muito idosos com história de quedas. São Paulo: Universidade Cidade de São Paulo; 2008, 86 pp.
41. Mukaka MM. Statistics Corner: a guide to appropriate use of correlation coefficient in medical research. *Malawi Med J.* 2012;24:69–71.
42. Schober HC, Maass K, Maass C, Reisinger EC, Schröder G, Kneitz C. Value of fall-risk tests for patients with rheumatoid arthritis. *J Rheumatol.* 2011;70:609–14.