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## Brief communication

# The influence of physical function on the risk of falls among adults with rheumatoid arthritis<sup>☆</sup>



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### ABSTRACT

**Objectives:** Identify fall prevalence in the last 12 months among patients with rheumatoid arthritis (RA) and verify the influence of disease activity and physical function in the risk of falls.

**Methods:** 43 patients with RA participated in this study. The following parameters were evaluated: clinical aspects; fall occurrence in the last 12 months; ESR (mm/h); pain on a visual analogue scale (VAS) ranging from 0 to 10 cm; disease activity, measured by the Disease Activity Score 28/ESR (DAS-28/ESR); physical function, assessed by the Health Assessment Questionnaire (HAQ); and risk of falling, assessed by two tests, the 5-time sit down-to-stand up test (SST5) and the get up and go timed test (GUGT).

**Results:** The fall prevalence in the last 12 months was 30.2% (13/43). The HAQ total score was the independent risk factor that had significant influence on SST5 performance, and the other variables did not succeed to explain the SST5 variability. HAQ explained 42.9% of SST5 variability ( $P < 0.001$ , adjusted  $R^2 = 0.429$ ). HAQ total score and ESR had a significant influence on GUGT score performance. Together, these two variables explained 68.8% of the total variation in GUGT score (adjusted  $R^2 = 0.688$ ).

**Conclusion:** Patients with RA have high fall prevalence and the functional disability represents the main factor related to falls risk.

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## Influência da capacidade funcional no risco de quedas em adultos com artrite reumatoide

### RESUMO

**Objetivos:** Identificar a prevalência de quedas nos últimos 12 meses em pacientes com artrite reumatoide (AR) e verificar a influência da atividade da doença e da capacidade funcional no risco de quedas.

#### Palavras-chave:

Artrite reumatoide

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Capacidade funcional  
Atividade da doença

**Pacientes e métodos:** Participaram do estudo 43 pacientes com AR. Foram avaliados os seguintes parâmetros: aspectos clínicos; ocorrência de quedas nos últimos 12 meses; VHS (mm/h); dor, através da escala visual analógica (EVA) com escore de 0 a 10 cm; atividade da doença, medida pelo Índice de Atividade da Doença – 28/VHS (*Disease Activity Score 28 – DAS-28/VHS*); capacidade funcional, avaliada pelo Questionário de Avaliação da Saúde (*Health Assessment Questionnaire – HAQ*); e o risco de quedas, avaliado por meio de dois testes, o teste senta-levanta da cadeira cinco vezes (TSL) e o teste *get up and go timed test* (GUGT).

**Resultados:** A prevalência de quedas nos últimos 12 meses foi de 30,2% (13/43). O fator independente que influenciou significativamente o desempenho no TSL foi o escore total do HAQ, sendo que as demais variáveis não conseguiram contribuir de forma significativa na explicação da variabilidade no TSL. A variável HAQ foi responsável por explicar 42,9% ( $P < 0,001$ ,  $R^2$  ajustado = 0,429) da variabilidade do TSL. As variáveis HAQ e VHS influenciaram de forma significativa o desempenho no escore do GUGT. Esses dois fatores em conjunto foram capazes de explicar 68,8% da variabilidade do GUGT ( $R^2$  ajustado = 0,688).

**Conclusões:** Pacientes com AR têm prevalência de quedas aumentada, sendo a incapacidade funcional o principal fator relacionado ao risco de quedas.

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## Introduction

Patients with rheumatoid arthritis (RA) are in increased risk of falls, as they often experience muscle weakness, joint pain or stiffness and disorders of balance and gait. The risk of falling is even greater when there is involvement of the lower extremities.<sup>1-3</sup>

Studies in this population demonstrate an increased rate of falls, from 27-50% over a year of research.<sup>3-7</sup> However, due to shortage of papers on this subject, the prevalence of falls may be underestimated.<sup>1</sup>

Falls are the leading cause of accidental death in people over 65 years old.<sup>8</sup> Approximately 40-60% of falls among the elderly lead to some kind of injury. Of the total injuries, 30 to 50% are considered of minor severity, 5-6% are considered as more serious injuries and 5% result in fractures.<sup>8-10</sup>

Few studies involving patients with RA have focused on the evaluation of falls, despite being considered a population at risk.<sup>1</sup>

Thus, the purpose of this study was to identify the prevalence of falls in a period of 12 months, in addition to verifying the influence of disease activity and of functionality in the risk of falls in patients with rheumatoid arthritis.

## Patients and methods

### Patients and Procedures

This study has a cross-sectional design.

Patients in our referral center with a diagnosis of RA according to American College of Rheumatology criteria (ACR, 1987)<sup>11</sup> were included after signing the free informed consent term. The study was approved by the local Research Ethics Committee (Protocol No. 013/2012).

Exclusion criteria were: age under 30 years; hospitalization due to acute illness in the previous six months from the interview; and presence of any temporary disability preventing the

participant from performing the mobility tests. The subjects were first asked to answer a questionnaire about: (1) identification data; (2) duration of illness; (3) presence of comorbidities; (4) use of a gait supportive gear; (5) history of arthroplasty; (6) history of falls in the past 12 months; (7) occurrence of fractures secondary to falls; (8) lifestyle; and (9) current medications.

To evaluate the activity of RA, the following variables were used: ESR (mm/h); pain using a visual analog scale (VAS) with a score of 0 to 10 cm; and Index of Disease Activity-28/ESR (*Disease Activity Score 28 - DAS-28/ESR*).<sup>12</sup>

The assessment of functional capacity of patients was estimated by the Health Assessment Questionnaire - HAQ.

To assess the risk of falls and the mobility of patients, two tests were performed: (1) 5-time sit down-to-stand up test (SST5) and (2) get up and go timed test (GUGT).

The 5-time sit down-to-stand up test (SST5) is used to assess the muscle strength of lower limbs, mobility and risk of falls.<sup>13,14</sup> In this test, the subject begins sitting on the center of a chair with his/her spine erect, feet separated by a distance equivalent to the distance between the shoulders, and arms folded across the thorax. Then the patient is asked to stand up and sit down on the chair five times as quickly as he/she can, without using his/her arms.<sup>13</sup>

The get up and go timed test (GUGT) is used to identify patients at risk of falls and for mobility restrictions.<sup>8,15</sup> In this test, the subject begins in a seated position with his back against the backrest of the chair, being asked to stand up (his/her arms can be used), walk for a distance of three meters in his/her usual gait speed, turn around, return to the chair and sit in the start position.<sup>15</sup>

The time spent to complete SST5 and GUGT tests is timed, and the longer the time, the worse the mobility of the subject.

### Statistical analysis

It was performed a regression analysis via Quasi-Likelihood method with variance function proportional to the mean and

**Table 1 – Patients' characteristics.**

Characteristic	Value
Patients, n	43
Women, n (%)	37 (86.0%)
Positivity for rheumatoid factor, n (%)	26 (60.5%)
Age (years), mean ± SD (min-max)	58.7 ± 9.1 (43-80)
Self-reported color, n (%)	
White	18 (41.9%)
Black	8 (18.6%)
Mixed (brown)	17 (39.5%)
Disease duration (years), mean ± SD (min-max)	12.2 ± 9.1 (1-30)
Use of a gait supportive gear, n (%)	8 (18.6%)
Presence of arthroplasty (knee and/or hip), n (%)	3 (7.0%)
HAQ, mean ± SD (min-max)	1.15 ± 0.78 (0-3)
DAS-28, mean ± SD (min-max)	4.01 ± 1.31 (0.8-6.8)
ESR (mm/h), mean ± SD (min-max)	29.86 ± 22.11 (3-118)
Pain by VAS (cm), mean ± SD (min-max)	4.74 ± 2.52 (0-10)
SST5 (seconds), mean ± SD (min-max)	15.07 ± 5.81 (8.3-25)
GUGT (seconds), mean ± SD (min-max)	17.40 ± 11.61 (9.2-60)
Smokers or ex-smokers, n (%)	24 (55.8%)
Practicing physical activity n (%)	6 (14.0%)

SD, standard deviation; HAQ, Health Assessment Questionnaire; DAS-28, Disease Activity Index- 28; ESR, erythrocyte sedimentation rate; VAS, visual analog scale used to assess pain; SST5, 5-time sit-to-stand test; GUGT, get up and go timed test.

a logarithmic link function in order to verify the influence of disease activity, functional capacity and other variables on the risk of falls.

In the multivariate regression final analysis, the Stepwise selection algorithm was used, referred to as Stepwise log-linear regression.

The level of significance was set at 5%. The statistical analysis was performed using R software version 2.15.3.

## Results

### Patients

According to exclusion criteria, one patient with limitation due to a fall was excluded because of a recent foot fracture that made it impossible to walk.

Forty-three patients participated in the study. Table 1 lists the characteristics of this population.

As for medications, the major pharmacological classes used in these patients were: disease-modifying antirheumatic drugs (DMARDs) (95.3%); calcium carbonate supplementation with vitamin D<sub>3</sub> (88.4%); corticosteroids (74.4%); gastric protectors (74.4%); bisphosphonates (53.5%); antihypertensive drugs (46.5%); nonsteroidal anti-inflammatory drugs (44.2%); and lipid-lowering drugs (37.2%). Ten patients (23.2%) were using central action drugs, as follows: 8 were taking antidepressants; 1 was on antidepressant and benzodiazepine therapy; and 1 was medicated with an anti-convulsant drug. And eight patients (18.6%) used biological agents for control of the disease.

Each patient presented a mean of 4 ± 2.1 comorbidities, ranging from 0 to 9. The four most prevalent comorbidities in this study were: osteoporosis (55.8%), secondary osteoarthritis (53.5%), hypertension (51.2%) and dyslipidemia (41.9%).

### Falls and fractures secondary to falls

At the time of the interview, 13 patients (30.2%) reported at least one episode of falling in the past 12 months.

Among the 13 patients who had suffered falls, only one reported a fracture secondary to fall (7.7%).

Five patients (11.6%) reported post-fall fractures that occurred earlier to the 12-month period of our analysis.

### Analysis of the influence of disease activity and functional capacity on the risk of falls

Table 2 shows the results of analyses of a univariate log-linear regression of the factors associated to the risk of falls, evaluated by SST5 and GUGT tests.

In the univariate model, a significant association was observed between risk of falls, rated by SST5, and the following variables: age ( $P=0.052$ ;  $R^2=0.070$ ), disease duration ( $P=0.045$ ,  $R^2=0.075$ ), ESR ( $P=0.032$ ;  $R^2=0.083$ ), number of comorbidities ( $P=0.041$ ,  $R^2=0.078$ ) and HAQ score ( $P<0.001$ ,  $R^2=0.429$ ) (Table 2).

Also in the univariate model, a significant association was observed between the risk of falls, rated by GUGT, and the following variables: ESR ( $P=0.001$ ;  $R^2=0.250$ ), presence of arthroplasty ( $P=0.038$ ,  $R^2=0.083$ ) and HAQ score ( $P<0.001$ ,  $R^2=0.665$ ) (Table 2).

In the final model of Stepwise log-linear regression with respect to the performance in SST5, only the HAQ variable was significant, and succeed to explain 42.9% of SST5 variability ( $R^2=0.429$ ) (Table 3).

As to the performance of subjects in GUGT, in the multivariate model the variables HAQ and ESR were significant in explaining, together, 68.8% of the variability of GUGT (adjusted  $R^2=0.688$ ) (Table 3).

## Discussion

This study identified the prevalence of falls in the past 12 months and evaluated the influence of disease activity and functional capacity in the risk of falls in adults with RA.

In this study, a prevalence of falls of 30.2%, similar to retrospective studies, has been found.<sup>3-5</sup> Functional disability was the main factor associated with risk of falls in this population.

Previous studies show different frequencies of falls in patients with RA. In retrospective studies, the occurrence of falls in patients with RA over a period of 12 months was 27%,<sup>4</sup> 33%<sup>3</sup> and 35%.<sup>5</sup> In prospective studies, the incidence of falls in 12 months ranged from 36.4%<sup>6</sup> to 50%.<sup>7</sup>

In this study, patients were inquired about the occurrence of falls in the past 12 months; thus, following a retrospective design. The literature demonstrates that retrospective studies may underestimate the prevalence of falls, since patients tend to forget progressively these episodes.<sup>16</sup> This factor constitutes a limitation, and may underestimate the prevalence of falls observed in our sample.

Regarding factors associated with risk of falls in patients with RA, the functional disability measured by HAQ total score was the primary factor found in this study.

**Table 2 – Result of the association among risk of fall (SST5 and GUGT) and evaluation parameters of disease activity (ESR, VAS and DAS-28) and functional capacity (HAQ).**

Variable	SST5				GUGT			
	exp ( $\beta$ )	P-value	95% CI	R <sup>2</sup>	exp ( $\beta$ )	P-value	95% CI	R <sup>2</sup>
Age (years)	1.012	0.052	[1.000 - 1.025]	0.070	1.017	0.116	[0.996 - 1.038]	0.046
Disease duration (years)	1.013	0.045	[1.001 - 1.025]	0.075	1.012	0.305	[0.990 - 1.034]	0.002
ESR (mm/h)	1.005	0.032	[1.001 - 1.01]	0.083	1.012	0.001	[1.005 - 1.018]	0.250
Pain by VAS (cm)	1.021	0.398	[0.974 - 1.069]	0.000	1.015	0.729	[0.935 - 1.101]	0.000
Number of comorbidities	1.058	0.041	[1.004 - 1.115]	0.078	1.095	0.06	[0.999 - 1.199]	0.079
Presence of arthroplasty	1.158	0.506	[0.755 - 1.777]	0.000	1.859	0.038	[1.056 - 3.273]	0.083
Positive rheumatoid factor	0.932	0.561	[0.736 - 1.18]	0.000	0.889	0.574	[0.592 - 1.335]	0.000
DAS-28	1.06	0.215	[0.968 - 1.159]	0.015	1.11	0.185	[0.954 - 1.292]	0.025
HAQ	1.365	<0.001	[1.227 - 1.518]	0.429	1.796	<0.001	[1.585 - 2.035]	0.665

Univariate log-linear regressions.

ESR, erythrocyte sedimentation rate; VAS, visual analog scale used to assess pain; DAS-28, Disease Activity Index- 28; HAQ, Health Assessment Questionnaire; SST5, 5-time sit-to-stand test; GUGT, get up and go timed test.

**Table 3 – Influence of functional capacity (HAQ) and ESR on the risk of falls, evaluated by SST5 and GUGT tests.**

Variable	SST5				GUGT			
	exp ( $\beta$ )	P-value	95% CI	Adjusted R <sup>2</sup>	exp ( $\beta$ )	P-value	95% CI	Adjusted R <sup>2</sup>
HAQ	1.365	<0.001	[1.227-1.518]	0.429	1.684	<0.001	[1.471-1.928]	0.688
ESR (mm/h)	-	-	-	-	1.004	0.0477	[1.001-1.008]	

Stepwise log-linear multivariate regression.

HAQ, Health Assessment Questionnaire; ESR, erythrocyte sedimentation rate; SST5, 5-time sit-to-stand test; GUGT, get up and go timed test.

Böhler *et al.*<sup>4</sup> found a correlation among the tests for assessment of the risk of falls, among them SST5 and GUGT, with the following variables: HAQ, DAS- 28, pain by VAS, and ESR. In the specific case of ESR, these authors found a correlation only with GUGT and not with SST5. Similar to our study findings, HAQ influenced the performance of both tests used to assess the risk of falls; on the other hand, ESR only acted on GUGT.

Duyurçakıt *et al.*<sup>17</sup> found a positive association between history of falls and performance on the Tinetti test used to assess the risk of falls. These authors also observed an association between fear of falling and Tinetti and HAQ final scores. The authors found no association between disease activity and the risk of falls.

The influence of functional disability in the risk of falls, as found in our study, was an expected finding. In patients with RA, other authors found an association of high HAQ scores with joint destruction and with decreased muscle strength, the latter being considered as risk factor for falls.<sup>18-20</sup>

In the present study, no association was found between disease activity, as assessed by DAS- 28, and an increased risk of falls. However, an association between the value of ESR and performance on GUGT test was found.

Due to the existing limitations in counting the joints used in DAS-28, some authors recommend adding other forms of disease activity assessment, such as laboratory tests, self-reported measures in questionnaires, and global estimates made by doctors and patients.<sup>21</sup>

With regard to associated factors of risk of falls, this study has some limitations. Most patients showed a moderate level of disease activity, calculated by DAS- 28, which, together with

the sample size, may have some influence in the lack of association between DAS- 28 and the risk of falls. Furthermore, the influence of other factors on the risk of falls, such as the use of certain classes of drugs (antihypertensive drugs, diuretics, antidepressants and sedatives) was not analyzed.

In our study, the age limit of 30 years was established, since the peak incidence of RA occurs between the fourth and sixth decades of life. It is worth to mention that the prevalence of RA increases with age; and the literature points to an increasingly aging profile of patients with RA.<sup>22</sup> The mean age of our sample was 58.7  $\pm$  9.1 years.

We also observed that osteoporosis was the most prevalent comorbidity (55.8%). Osteoporosis is associated with fracture risk.<sup>23</sup> Studies evaluating injuries from falls show that hip, wrist, vertebrae, humerus and hand fractures are mainly caused by falls.<sup>24</sup>

The relevance of this study is to point out an increased prevalence of falls in patients with RA. Moreover, our paper draws attention to the impact of functional disability, measured by the HAQ score, on the risk of falls in this population.

In conclusion, patients with RA have an increased prevalence of falls, and functional disability is associated with the risk of falls in these individuals.

RA patients should be monitored for functional capacity and bone mass, aiming to prevent falls and consequently to prevent fractures, contributing to a better prognosis of rheumatic disease.

### Conflict of interests

The authors declare no conflicts of interest.



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