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Relationship between fear of falling and functional status in nursing home residents aged older than 65 years

Mirjana Kocic,[1,2] Zorica Stojanovic,[3] Milica Lazovic,[4,5] Dejan Nikolic,[4,6] Vesna Zivkovic,[1,2] Marina Milenkovic[3] and Konstansa Lazarevic[7]

[1]Physical Medicine and Rehabilitation Clinic, Clinical Center Nis, and [2]Faculty of Medicine, University of Nis, Nis, [4]Faculty of Medicine, University of Belgrade, [5]Institute for Rehabilitation, and [6]Physical Medicine and Rehabilitation Department, University Children's Hospital, Belgrade and [7]Department of Biomedical Sciences, State University of Novi Pazar, Novi Pazar and [3]College of Health Studies Cuprija, Cuprija, Serbia

Aim: The present study investigated the relationship between fear of falling and functional status, and sociodemographic and health-related factors in nursing home residents aged older than 65 years.

Methods: The cross-sectional study involved 100 participants who were residents of a nursing home and aged older than 65 years. Fear of falling was assessed using the Falls Efficacy Scale. Functional status was assessed by four performance-based measures. Balance was assessed by the Berg Balance Scale, mobility by the Timed Up and Go test, lower limbs muscle strength by the Chair Rising Test and participants' functional ability by the motor Functional Independence Measure.

Results: There was a significant negative correlation between the Falls Efficacy Scale and Berg Balance Scale ($P < 0.001$), and motor Functional Independence Measure ($P < 0.001$) scores; and a positive correlation with the Timed Up and Go test ($P < 0.001$) and Chair Rising Test ($P < 0.001$) values. Falls Efficacy Scale score increase is associated with age, being a widower/widow and the number of falls in the previous year. Higher fear of falling is associated with an increase in the number of falls in the previous year and with a decrease in Berg Balance Scale score.

Conclusions: The study found a significant associations between Falls Efficacy Scale score and all of the examined parameters of functional status, the number of falls in the previous year, age and marital status of widower/widow. The major finding was that poor balance and an increase in the number of falls in the previous year are independent factors significantly associated with the fear of falling. **Geriatr Gerontol Int 2017; 17: 1470–1476.**

Keywords: cross-sectional study, elderly, fear of falling, functional status, nursing home.

Introduction

The ratio of people aged over 65 years to the total number of the population has been increasing both in developed and developing countries. Falls affect approximately one-third of community-dwelling older adults each year.[1] Because of their high frequency, falls and their consequences represent a serious problem in the elderly population.[1,2] The consequences of most of the falls in older adults are physical injuries ranging from minor soft tissue injuries to serious fractures,[3] as well as various psychological consequences among which are fear of falling and activity avoidance.[4]

Fear of falling, according to Tinnetti *et al.*, refers to the lack of self-confidence in the ability to safely carry out basic activities of daily living (ADL) without falling.[5] These authors developed the instrument, "Falls Efficacy Scale" (FES), for assessing the fear of falling in order to determine the extent to which fear of falling exerts an independent effect on functional decline among older adults.[5] Later, similar multi-item instruments measuring the construct of self-efficacy, such as FES International and the Activities-specific Balance and Confidence Scale, among others, were developed as well.[6]

It should be pointed out that fear of falling means an overemphasized concern of falling that leads to restriction of activities.[7] Previous studies showed that physical activity levels are lower in people who have fear of falling.[1,4] Jefferis *et al.*, found that the association between fear of

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Correspondence: Professor Mirjana Kocic MD PhD, Faculty of Medicine, University of Nis, Nis, Serbia, Physical Medicine and Rehabilitation Clinic, Clinical Center Nis, Nis, Serbia, Dr Zoran Djindjic Blvd. 48, 18 000 Nis, Serbia. Email: kocicm60@gmail.com

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falling and activities level is independent of fall history.[1] Fear of falling has long-term negative consequences on physical and psychosocial functioning of older adults, such as limiting or avoiding activities,[1,4] loss of independence and decrease of the quality of life.[6,8] It can appear in older adults both after an experience of a fall and without one.[6] If it is not overemphasized, fear of falling does not represent a problem, but if it leads to avoidance of activities and reduction of functional abilities, then it becomes a risk factor for future falls.[9,10]

Causes of falls in older adults are multifactorial, including medical, psychosocial and environmental factors.[11] During the aging process, progressive physiological changes occur, and are manifested as muscle weakness, poor balance and reduced mobility.[12] These physiological changes lead to the decline in ability to carry out ADL, often with the loss of independence.[12] This is why older adults are often accommodated in institutions for older people. It has been noted that fall rates among institution residents are much higher than among community-dwelling older adults.[4] Each year more than 50% of older adults living in residential care facilities or nursing homes fall, and approximately 50% of these who fall tend to fall several times a year.[13]

Given the high prevalence of falls and fear of falling in nursing home residents, it is important to understand how fear of falling is associated with one's functional status for the purpose of developing better prevention strategies. Thus, it will improve residents' quality of life. As a country in transitional process with an increased number of nursing homes and with implementation of institutionalized care of persons of advanced age, the present study is the first study of older adults in Serbia dealing with the relationship between fear of falling and functional status in nursing homes.

The aim of the study was to investigate the relationship between fear of falling and functional status, and sociodemographic and health-related factors (comorbidity, fall history, number of medications and body mass index) in nursing home residents aged older than 65 years.

Methods

Participants

The present cross-sectional study involved 100 participants that were residents of a nursing home in Nis (Serbia). The inclusion criteria were: age older than 65 years, walking independently (use of walking aids is allowed), cognitively unimpaired and willingness to participate in the study. The exclusion criteria were: blindness, cognitive deficit (Mini-Mental State Examination score <24),[14] acute or terminal illnesses and severe chronic diseases that restrict ability to accomplish performance-based measures of functional status.

After applying the inclusion and exclusion criteria, 100 elderly participants were eligible for the study and all of them gave written informed consent to participate in the study. The study was approved by the ethics committee of the Faculty of Medicine, University of Nis.

Assessments

Data were gathered from September to November 2015 through face-to-face interviews, medical records, an interview-based questionnaire and performance tests. First, the data about sex, age, educational level, marital status, history of falling in the past year, number of regular medications, and comorbidity were collected through face-to-face interviews and medical records. Then, the participants' body height (without shoes) and weight (in light clothes, in the morning before meal and water intake) measures were taken, and body mass index was calculated. Afterwards, fear of falling was assessed using an interview-based questionnaire.

After the fear of falling assessment, the participants underwent four performance tests for functional status assessment. Functional status assessment included the assessment of balance, functional mobility, lower extremities strength and level of independence in carrying out ADL. For each task, the examiner first demonstrated the task. Between these assessments, the participants were given a 15-min rest. Each assessment was carried out by one of the authors of the present article.

Comorbidity

To estimate the comorbidity of participants, the Cumulative Illness Rating Scale for Geriatrics was used.[15] It identifies 14 items graded from 0 to 4 regarding severity (0, no medical problem; and 4, extremely severe medical problem). The results were presented as the severity index, where the severity index was calculated as the total Cumulative Illness Rating Scale for Geriatrics score divided by the number of endorsed categories. An estimation of comorbidity was carried out by a rehabilitation medicine specialist.

Fear of falling

Fear of falling was assessed using the interview-based FES.[5,16] The FES is a questionnaire recording the participant's concern about the possibility of falling while carrying out 10 basic ADL. FES scoring was standardized to provide a score ranging from 1 (full confidence) to 10 (no confidence). Total score can range from 10 to 100, with higher scores indicating lower confidence and thus greater fear of falling.

Balance

For balance assessment, the Berg Balance Scale (BBS) was used.[17] This test evaluates 14 tasks (5 static and

9dynamic) that are related to stability in sitting, standing, standing up, turning around, walking on an even surface, walking on steps and balance while changing body position. Each task was graded on a five-point scale with a range from 0 to 4 (0, the inability to perform a task; 4, the perfect performance of the task). The total score can range from 0 to 56, with a higher score representing better balance and reduced risk of falling. Walking aids were not allowed in the task performance. If a task could not be carried out without walking aids, it was graded 0.

Functional mobility

Basic functional mobility was evaluated using the Timed Up and Go test (TUG).[18] The TUG involves rising from a chair, walking, turning around, walking back to the chair and sitting down. Participants were instructed to complete the task at their usual pace. Walking aids were allowed in the task performance. The time is taken when the patients rise from an armchair, walk 3 m, cross a line on the floor, turn, walk back and sit down again. The task was carried out twice with a 5-min rest between each trial. The shorter of the times measured in the two trials was recorded.

Functional lower limbs muscle strength

Muscle strength of lower limbs was assessed indirectly by the Chair Rising Test (CRT).[19] A standard chair with no arms and a seat height of approximately 43 cm was used. A straight-backed chair was placed next to a wall. Participants were asked to fold their arms across their chest, and to stand up and from the chair once. If successful, participants were asked to stand up and sit down five times as quickly as possible, and were timed from the initial sitting position to the final standing position at the end of the fifth stand. The test was carried out twice with a 5-min rest between each trial. The shorter of the times measured in the two trials was recorded.

Level of physical disability

For evaluation of a level of the participant's physical disability, motor Functional Independence Measure (mFIM) was used.[20] The mFIM score measures the degree of independence on a sample of 13 items of ADL divided into four areas: self-care activities, sphincter control, transfers and locomotion. Each item is graded from 1 (complete dependence) to 7 (complete independence). Possible mFIM scores range from 7 to 91, with higher scores indicating more independence. Functional ability was evaluated by a trained nurse and the rehabilitation medicine specialist who observed and scored each patient carrying out the stated 13 activities of daily living.

Statistical analysis

All statistical analyses were carried out using SPSS (version 15.0; SPSS, Chicago, IL, USA). Categorical variables (sex, marital status, education and fall history in the previous year) are given as absolute numbers, *n* and in percentages (%). Continuous variables (age, number of falls in the previous year, FES, body mass index, SI, number of medications, BBS, TUG, CRT and mFIM) are given as means ± SD (medians). Statistical significance was defined as a P-value <0.05. The significance of the differences of continuous variables between the two independent groups was analyzed using the Student's t-test and Mann–Whitney U-test, as appropriated, and between more than two groups using ANOVA or Kruskal–Wallis test, depending on data distribution. Categorical variables were analyzed using Pearson's χ^2-test or Fisher's exact test. The correlations between FES and other continuous variables were assessed by Pearson's linear correlation coefficients. Univariate and multivariate linear regression analyses were used to identify factors significantly associated with the FES values. Based on significant characteristics of interest for FES values, obtained from univariate linear regression (enter method), multivariate linear regression (stepwise method with age and sex as control variables) was carried out.

Results

The study included 100 participants, aged 65–95 years. Basic descriptive characteristics of the participants are shown in Table 1.

The values of Pearson's linear correlation coefficient of FES score with examined parameters of interest are presented in Table 2. There was a statistically significant negative correlation between FES and BBS and mFIM scores, and a positive correlation with TUG, CRT values, age and number of falls ($P < 0.001$).

Values of FES score according to sex, marital status, education level and fall history in the previous year are presented in Table 3. FES score was higher in women than in men, but not statistically significant ($P > 0.05$). It was similar in participants with different levels of education. FES score was significantly higher in the widows/widowers than in the divorced and married ($P < 0.05$), and it was also significantly higher in participants who experienced two or more falls in the previous year compared with those who experienced one ($P < 0.05$) or none ($P < 0.001$).

To estimate the influence of the examined parameters on the FES score, a univariate linear regression analysis (enter method) was carried out. The relationship between the FES score and statistically significant parameters is shown in Table 4. An increase of the FES score was associated with age, number of falls, being a widower/widow, TUG and CRT. A decrease of the FES score was associated with BBS and mFIM.

All factors significantly associated with FES were included in the model for multivariate linear regression

Table 1 Characteristics of study group

Characteristics	Mean ± SD	Median
Age (years)	78.01 ± 8.21	79.00
Number of falls in the previous year	1.14 ± 1.58	0.50
FES (score)	45.83 ± 25.72	45.00
BMI (kg/m^2)	24.92 ± 4.96	24.30
SI	1.96 ± 0.31	2.00
No. medications	4.04 ± 1.80	1.80
BBS (score)	43.37 ± 9.73	45.00
TUG (s)	20.11 ± 10.54	16.40
CRT (s)	12.45 ± 4.35	12.00
mFIM (score)	85.92 ± 6.63	88.50
	n (%)	
Sex (male/female)	36 (36%) / 64 (64%)	
Marital status (widower/divorced/unmarried/married)	64 (64%)/26 (26%)/6 (6%)/4 (4%)	
Education (primary/secondary/high-university)	43 (43%)/40 (40%)/17 (17%)	
Fall history in the previous year (none/one/two or more)	50 (50%)/25 (25%)/25 (25%)	

Continuous variables are given as means ± SD (medians) and categorical variables as absolute numbers (*n*) and in percentages (%). BBS, Berg Balance Scale; BMI, body mass index; CRT, Chair Raising Test; FES, Falls Efficacy Scale; mFIM, motor Functional Independence Measure; SI, Severity Index; TUG, Timed Up and Go.

Table 2 Correlation of FES score with functional ability, health-related factors and age

Variable	*r*	*P*
Age	0.36	<0.001
No. falls	0.45	<0.001
BMI	–0.12	>0.05
SI	–0.03	>0.05
No. medications	0.19	>0.05
BBS	–0.68	<0.001
TUG	0.56	<0.001
CRT	0.47	<0.001
Motor FIM	–0.53	<0.001

BBS, Berg Balance Scale; BMI, body mass index; CRT, Chair Raising Test; mFIM, motor Functional Independence Measure; *r*, Pearson's linear correlation coefficient; SI, Severity Index; TUG, Timed Up and Go.

analysis (stepwise method, controlled for age and sex). In the final model, the number of falls in the previous year and the BBS score were the only factors that remained significantly associated with FES (Table 4). Any increase of the number of falls in the previous year was associated with an increase of FES score by 3.20 (0.62–5.78; $P < 0.05$). Any increase in the BBS score by 1 point was associated with a decrease of the FES score by 1.54 (–1.08 to –1.99; $P < 0.001$). The multiple correlation coefficient (R) was 0.709. Based on the value of R square (R^2), it can be concluded that 50.3% of the variance of FES was determined by a set of significant factors that were included in the final regression model.

Table 3 Falls Efficacy Scale score according to sex, marital status, education level and fall history in the previous year

	Mean ± SD	Median
Sex		
Male	41.25 ± 28.37	36.50
Female	48.41 ± 23.94	48.50
Marital status		
Widow/widower	51.05 ± 25.79†*,‡*	55.00
Divorced	37.54 ± 24.49	34.50
Never married	42.00 ± 20.40	49.50
Married	22.00 ± 14.07	18.00
Education level		
Primary	47.70 ± 25.70	46.00
Secondary	44.48 ± 25.90	45.00
High school/university	44.29 ± 26.59	41.00
Fall history in the previous year		
None	39.22 ± 22.52	41.00
One	42.84 ± 27.36	34.00
Two or more	62.04 ± 23.88§**,¶*	71.00

Data are given as mean ± SD (medians). *$P < 0.05$, **$P < 0.001$. †Versus divorced. ‡Versus married. §Versus none. ¶Versus one.

Table 4 Association between significant factors of interest and Falls Efficacy Scale score

	B	95% CI for *B*	*P*
Univariate analysis			
Age	1.13	0.54–1.72	<0.001
Widow/widower	14.49	4.21–24.78	<0.01
No. falls	7.29	4.38–10.21	<0.001
BBS	–1.80	–2.19 to –1.41	<0.001
TUG	1.37	0.96–1.77	<0.001
CRT	2.77	1.72–3.82	<0.001
mFIM	–2.06	–2.72 to –1.41	<0.001
Multivariate analysis (stepwise method, controlled for age and sex)			
Age	0.08	–0.44–0.60	>0.05
Gender	–4.21	–11.89–3.48	>0.05
BBS	–1.54	–1.99 to –1.08	<0.001
Number of falls	3.20	0.62–5.78	<0.05
Constant	103.95	51.92–155.98	<0.001
	$R = 0.709$		$R^2 = 0.503$

Results of univariate and multivariate regression analysis. BBS, Berg Balance Scale; CI, confidence interval; CRT, Chair Raising Test; mFIM, motor Functional Independence Measure; TUG, Timed Up and Go.

Discussion

In the present study, a strong relationship between fear of falling and all of the examined parameters of functional status (BBS, TUG, CRT and mFIM) was found in the nursing home residents aged older than 65 years. Furthermore, we showed a strong relationship between fear of falling and the number of falls and age, as well as marital status in the study population. A higher fear of falling is associated with a increase in the number of falls in the previous year and with a decrease in BBS score.

Fear of falling is recognized as an important screening test for estimation of risk of falling.[21,22] Long-term reduction in activity as a result of the fear of falling leads to reduced functional abilities, a decrease in muscle strength and poor balance.[1,9] Fear of falling in the present study was assessed by the FES questionnaire, because it has been proven to provide more consistent information on the level of fear of falling than a single question "Do you fear of falling?"[23] Furthermore, we have not considered FES International and Activities-specific Balance and Confidence Scale questionnaires, as they are less appropriate for the population of institutionalized older people because they include, among others, items of social and difficult activities.[6] Functional status was assessed by four performance-based measures used for evaluation of balance, functional mobility, muscle strength of lower extremity and the degree of functional independence in ADL.

The most important finding of the study was that BBS is an independent factor significantly associated with a fear of falling. The BBS assesses balance ability with 14 tasks, and is more precise than other tests. It is used to assess static and dynamic balance, mainly assessing balance while sitting or standing, and is more appropriate for evaluation of institutionalized older adults.

However, we have found only one study that examined the relationship between fear of falling and BBS, and that study found a strong negative correlation between BBS and FES score, which is in agreement with the present results.[24] Other authors also found a close relationship between fear of falling and balance, but in their studies balance was measured by other tests.[21,25]

In the present study, balance and functional mobility were also assessed by TUG, a simple and quick test, more widely used in studies than BBS. We found a positive and strong correlation between FES and TUG, which is consistent with results obtained by Kumar *et al.*[24] Other studies also showed a significant correlation between fear of falling and TUG, but in those studies fear of falling was assessed by other questionnairies[21,22,26] or a single fear of falling question.[25] We also found a significant correlation of FES with CRT and mFIM, which is consistent with other studies' findings.[27,28]

For more precise and complete functional status assessment, we used four performance tests. Such selection of the aforementioned tests and their combination was not in this way studied and presented in the literature. A strong relationship between fear of falling and balance, as well with lower extremities muscle strength, was found in the present study, showing that the exercise program for the prevention of falls should be focused on balance with additional exercise modalities for lower extremities strength improvement.

Previous falls carry higher risk of falling recurrence, and thus influence the development of fear of falling. The rate of prevalence of fear of falling ranges from 21% to 85% in people who have previously fallen, and from 33% to 46% in those who have not.[21] Previous results stressed the association of fear of falling and the number of falls.[4,8,21,22] Lash *et al.* found that two or more previously experienced falls represented an independent predictor for fear of falling increase.[7] The present study found that the number of falls in the previous year was an independent factor for the fear of falling increase measured by FES.

Female sex has been reported to be a significant risk factor for developing a fear of falling.[4,7,8,29] However, we did not find significant differences in FES scores between women and man, which is consistent with the findings of the study of Hellström *et al.*[28] Furthermore, we found a relationship between fear of falling and the increase of age, which is consistent with previous reports.[25,29]

The present study had some strengths and limitations that should be considered when interpreting the results.

The main strength of the present study was that all physical performances were assessed by one of the authors who had been a rehabilitation medicine specialist for more than 10 years, enabling uniform criteria of data collection. Furthermore, the administration method we used was the interview-based fear of falling assessment, not self-report. In the study of Hauer *et al.*, an interview-based administration method was found to be superior to self-reported data because of better completion rates (100% completion).[30]

The main limitations of the present study were that it processed data obtained from only one nursing home and included a relatively small sample size. Also, the cross-sectional design of the study did not allow us to establish a causal pathway between FES and functional status.

Despite these limitations, the present study showed that all four tests that were used for functional status assessment (BBS, TUG, CRT, mFIM) can be used in nursing homes to predict fear of falling. Based on multivariate regression analysis, only BBS remained as an independent factor significantly associated with the fear of falling.

According to the results of the study, the evaluation of balance by BBS should be included as a part of a routine examination for assessment of fear of falling in nursing homes residents. Balance, being a potentially modifiable factor, can be improved by the use of the appropriate exercise protocol based on balance exercises. Better balance would lead to a reduction in the fear of falling and thus to a reduction in the risk of a fall, which is important for improving the quality of life of institutionalized older adults.

These findings will be of great benefit for future planning of healthcare and treatment modalities for the older population with regard to the improvement of functional status and, ultimately, quality of life.

In conclusion, the results of the present study show a significant relationship between FES score and all the examined parameters of functional status (BBS, TUG, CRT and mFIM) in nursing home residents. Among other investigated parameters, a significant association between FES score and the number of falls in the previous year, age, and marital status of widower/widow was found. The major finding of the present study was that the increase in BBS score and number of falls during a year are factors that are significantly associated with fear of falling. The combination of these two independent factors explains approximately 50% of the variance, suggesting that improving the balance altogether with the absence of falling significantly contributes to the decrease of fear of falling and thus reduces the risk of a fall.

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Disclosure statement

The authors declare no conflict of interest.

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