

## ORIGINAL ARTICLE / ОРИГИНАЛНИ РАД

# Identifying elderly persons who are at risk of falling and fall risk factors in the general population

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## SUMMARY

**Introduction/Objective** The aim of this study was to identify the elderly who are at increased risk of falling, as well as the risk factors for falls in the general population.

**Methods** This cross sectional study included a random sample of 400 people (164 men and 236 women) with the average age of 75.04 (65–94) years selected from the Register of the Primary Health Center in Niš, Serbia. Socio-demographic questionnaire, the Elderly Fall Screening Test, and the Multi-factor Falls Questionnaire were used. Odds ratio (OR) was evaluated and adjusted for gender, age, marital status, education level, and self-assessment of the health state.

**Results** The risk of falling and risk factors for falls were as follows: age [odds ratio (OR) = 1.129, confidence interval (CI) = 1.067–1.196], health self-assessed as good (OR = 0.365; CI = 0.142–0.938), limitation of activities (OR = 7.189; CI = 3.559–14.522), walking problems (OR = 2.153; CI = 1.046–4.428), osteoporosis (OR = 4.611; CI = 1.231–17.265), female gender (OR = 3.770, CI = 1.648–8.624), vision problems (OR = 2.719; CI = 1.588–108.581), cognitive problems (OR = 4.485; CI = 17.721), arthritis (OR = 6.524; CI = 2.077–20.496), and urination problems (OR = 2.511; CI = 1.083–5.820).

**Conclusion** Risk factors for falls were the following: age, self-assessment of health state, walking problems, osteoporosis, female gender, vision problems, arthritis, and urination problems.

**Keywords:** the elderly; risk of falling, factors, assessment; general population

## INTRODUCTION

The incidence of falls and the severity of complications due to falls increase after the age of 60 years [1]. Falls are attributed to risk factors of falling. Worldwide, the proportion of people older than 80 years, or the “oldest old” population of the elderly, was 14% in 2013 and it is expected to increase to 19% in 2050. If this percentage of old people is reached, there will be 392 million people aged 80 and older in 2050. According to data provided by the World Health Organization, women surpass men almost everywhere, because women are predisposed to live longer than men [2]. Based on the results provided by the Statistical Office of the Republic of Serbia, the fact that the population of Serbia is in the trend of progressive aging is confirmed [3]. The aging of the population is a global trend today. This actually means that people today are generally healthier and live longer. While global aging represents a triumph of health, social, economic, and progress over the control of diseases, it also poses enormous challenges [4]. In order for people

to live longer and healthier than ever before, it is necessary to provide greater support and medical care as elderly are more demanding in the process of nursing care than young people are. The government needs to invest more time and money in the organization of health care in the population of elderly compared to other age groups. The aim to improve health and reduce functional disability of the elderly is conditioned by connecting simultaneous technological development with scientific knowledge of gerontology, in order to improve and make life easier for the elderly [5]. These investments are related to covering costs, which include admission to hospital, treatment, rehabilitation, and home care, and amount to almost 19,440 euros for each old person who has suffered injuries due to a fall, which is an extremely high cost. Generally, this is one of the reasons why it is important to direct more attention to prevention of fall rather than to treatment of the consequences of fall. It is also advisable to set the main focus more on risk factors for falls, instead of on only one risk factor [6].

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## METHODS

### Research sample

The study included 400 respondents of both genders (164 male and 236 female). All participants had residence in the city of Niš. As there was no relevant information in the Republic of Serbia on the subject that we were researching, in order to determine optimal sample size, we used the variability of the phenomenon of 50% [7].

According to the healthcare service register of the Primary Health Center in Niš, where a comparative overview was given for the year 2009, the overall number of people in the city of Niš amounted to 255,479. The number of people aged 65 years and older was 44,378. Therefore, we concluded that the sample of 384 respondents would be sufficient. A random sample was used thanks to data obtained from the Niš Primary Health Center Registry.

Inclusive criteria were the following: age of 65 years and older, with residence in a house or apartment, being able to understand, comprehend, and follow the instructions, and being mobile (with or without mobility aid).

This study was approved by the Ethical Committee of the Faculty of Medicine, University of Novi Sad, the Ethical Committee of the Niš Primary Health Center, the managing director of the Niš Primary Health Center.

### Study design

The survey was conducted as a cross-sectional study during the January–June 2014 period. The data was collected by using the survey method during the home visits by researchers in the presence of visiting nurses.

### Instruments

General socio-demographic questionnaire contains eight questions relating to age, gender, place of residence, marital status, education level, income satisfaction, assessment of health, and number of household members.

Fall screening test for people aged 65 and older (Elderly Fall Screening Test – EFST) is designed to detect the level of risk of falling. It contains the following five items: history of falls and crashes, injuries due to falls, experience of near-falls, and the current walking condition (assessed walking speed and walking pattern) [8]. The sensitivity of the test is 83% and the specificity is 69%, which was found in the study by Cwik et al. [9]. The values of each question (0 points – no risk of falling or 1 – there is a risk of falling) are summed up, giving a total score. The score between 0 and 1 refers to the category of persons with no or low risk for falls, while the score  $\geq 2$  refers to the category of persons with moderate or high risk of falls. In order to gain an insight into the disorders of health status, a questionnaire for the assessment of multiple risk factors for falls was used (Multi-Factor Falls Questionnaire – MFQ) [8]. The total MFQ result was calculated as the sum of results obtained in all groups of risk factors for falls. The risk of falling was dichotomized according to the total score: moderate risk (total score  $\leq 3$ ), and high risk (total score  $> 3$ ) [8].

### Independent variables

Basic socio-demographic data were as follows: gender, age, marital status, place of residence, education level, income satisfaction, health assessment, and community life. The following four age groups were set: 1) 65–69 years, 2) 70–74 years, 3) 75–79 years, and 4) over 80 years. When it comes to health disorders, the following variables were evaluated: activity limitation due to falling, problems with vision, symptoms of cognitive problems, dizziness, problems with balance, problems with walking/mobility, arthritis, osteoporosis, orthostatic hypotension, the use of aids, the use of multiple drugs (three or more), and problems with micturition.

### Statistical analysis of the data

Univariate and multivariate logistic regression analyses were used in order to determine predictive factors. The statistical hypothesis was tested at a significance level of  $\alpha = 0.05$ . Statistical calculations were performed using the SPSS version 16 (SPSS Inc., Chicago, IL, USA).

## RESULTS

Our study included 400 participants, 164 (41%) male and 236 (59%) female, aged between 65 and 94 years, with an average of 75.04 (SD = 5.85). In men, the average age was  $\bar{x} = 74.81$ ; (SD = 5.77), while in women it was  $\bar{x} = 75.20$ ; (SD = 5.91). The largest number of participants was married (66%), resided in a city (53.5%), while more than half reported that they lived alone (52.8%). Education level ranged from unfinished primary school, in the highest percentage (37.3%), up to a high school degree, in the lowest percentage (2.5%). The health was assessed as poor (38.8%), average (45.8%), or good (15.5%). Most participants (79%) were not satisfied with their income, i.e. they pleaded that their revenues did not meet their needs.

In order to identify elderly individuals who are at risk of falling in relation to sociodemographic characteristics and health problems, several significant variables are singled out by the univariate logistic regression analysis. The following variables were used: gender, age, marital status, residence, type of residence, education level, number of household members, satisfaction with income, health assessment, limitation of activity due to falling, problems with vision, symptoms of cognitive problems, dizziness, problems with balance, problems with walking/mobility, arthritis, osteoporosis, orthostatic hypotension, use of aids, the use of multiple drugs (three or more), and micturition problems (Table 1).

The univariate logistic regression analysis evaluated the probability of certain socio-demographic factors for the falls according to the EFST scale. The results show that the probability of fall is 2.842 times higher in female [odds ratio (OR) = 2.586;  $p < 0.001$ ], and is significantly increased with the age of 75–80 years, by more than three times (OR = 3.606;  $p < 0.001$ ) and in persons older than 80 years by more than eight times (OR = 8.498;  $p < 0.001$ ). The probability of falling is 1.737 times higher in widowers (OR = 1.737;

**Table 1.** Results of a univariate logistic regression analysis of sociodemographic factors and health problems for the assessment of the risk of falling according to the Elderly Fall Screening Test scale

Variables		Without and low risk of falling n (%)	Moderate and high risk of falling (%)	OR	95% CI	p
Gender	[male]	70 (58.8)	94 (33.5)	/	/	/
	female	49 (41.2)	187 (66.5)	2.842	1.828–4.418	< 0.001
Age (years)	[65–69]	42 (35.3)	43 (10.8)	/	/	/
	70–74	41 (34.5)	55 (19.6)	1.310	0.729–2.356	0.367
	75–79	26 (21.8)	96 (34.2)	3.606	1.965–6.618	< 0.001
	≤ 80	10 (8.4)	87 (31.0)	8.498	3.894–18.546	< 0.001
Marital status	[married]	93 (78.2)	178 (63.3)	/	/	/
	single	0 (0.0)	1 (0.4)	0.001	0.005–0.002	0.998
	divorced	3 (2.5)	9 (3.2)	1.567	0.414–5.929	0.508
	widow/er	23 (19.3)	93 (33.1)	2.113	1.255–3.556	0.005
Residence	[rural]	52 (43.7)	134 (47.7)	/	/	/
	urban	67 (56.3)	147 (52.3)	0.851	0.553–1.311	0.465
Type of residence	[house]	108 (90.8)	253 (90.0)	/	/	/
	apartment	11 (9.2)	28 (10.0)	1.087	0.522–2.261	0.824
Level of education	[primary school]	60 (50.4)	208 (74.0)	/	/	/
	> primary school	59 (49.6)	73 (26.0)	0.357	0.228–0.558	< 0.001
Numbers of members	Household	2.56±1.50	2.50±1.52	0.974	0.846–1.121	0.711
Satisfaction of income	[yes]	16 (13.4)	35 (12.5)	/	/	/
	no	91 (76.5)	225 (80.1)	1.130	0.596–2.143	0.707
	partially	12 (10.1)	21 (7.5)	0.800	0.318–2.015	0.636
Health assessment	[poor]	17 (14.3)	138 (49.1)	/	/	/
	average	66 (55.5)	117 (41.6)	0.218	0.121–0.393	< 0.001
	good	36 (30.3)	26 (9.3)	0.089	0.044–0.181	< 0.001
Limitation of activity	[no]	104 (87.4)	99 (35.2)	/	/	/
	yes	15 (12.6)	182 (64.8)	12.746	7.037–23.088	< 0.001
Problems with vision	[no]	101 (84.9)	141 (50.2)	/	/	/
	yes	18 (15.1)	140 (49.8)	5.571	3.204–9.688	< 0.001
Cognitive problems	[no]	70 (58.8)	89 (31.7)	/	/	/
	yes	49 (41.2)	192 (68.3)	3.082	1.978–4.801	< 0.001
Problems with balance	[no]	98 (82.4)	96 (34.2)	/	/	/
	yes	21 (17.4)	185 (65.8)	8.993	5.283–15.307	< 0.001
Problems with walking	[no]	83 (69.7)	69 (24.6)	/	/	/
	yes	36 (30.3)	212 (75.4)	7.084	4.400–11.405	< 0.001
Arthritis	[no]	89 (74.8)	165 (58.7)	/	/	/
	yes	30 (25.2)	116 (41.1)	2.086	1.294–3.361	< 0.001
Osteoporosis	[no]	115 (96.6)	235 (83.6)	/	/	/
	yes	4 (3.4)	46 (16.4)	5.628	1.978–16.014	0.001
Orthostatic hypotension	[no]	99 (83.2)	189 (67.3)	/	/	/
	yes	20 (16.8)	92 (32.7)	2.410	1.402–4.140	0.001
Aids	[no]	114 (95.8)	196 (69.8)	/	/	/
	yes	5 (4.2)	85 (30.2)	9.888	3.897–25.086	< 0.001
Problems with urination	[no]	70 (58.8)	140 (49.8)	/	/	/
	yes	49 (41.2)	141 (50.2)	1.439	0.933–2.220	0.100

[ ] – reference group; OR – odds ratio; CI – confidence interval

$p = 0.005$ ). Participants who have finished more than primary school have lower risk of falling (OR = 0.357;  $p < 0.001$ ). Participants who assessed their health as average (OR = 0.227;  $p < 0.001$ ) or good (OR = 0.041;  $p < 0.001$ ) are less likely to fall compared to those who assess their health as poor.

All analyzed health conditions, except problems with urination, are independent predictors of the risk of falling: limiting activities (OR = 12.746,  $p < 0.001$ ), vision problems (OR = 5.571;  $p < 0.001$ ), cognitive problems

(OR = 3.082;  $p < 0.001$ ), problems with balance (OR = ~ 8.993;  $p < 0.001$ ), stroke (OR = 7.084;  $p < 0.001$ ), arthritis (OR = 2.086;  $p < 0.001$ ), osteoporosis (OR = 5.628;  $p < 0.001$ ), orthostatic hypotension (OR = 2.410;  $p < 0.001$ ), and the use of aids (OR = 9.888;  $p < 0.001$ ).

Multivariate logistic regression analysis was performed to assess the impact of combined statistically significant factors with relation to fall according to the EFST scale (Table 2). The whole model, including all the predictors, is statistically significant ( $\chi^2 = 182.134$ ,  $p < 0.001$ ) and

**Table 2.** Results of a multivariate logistic regression analysis to assess the risk of falling according to the Elderly Fall Screening Test scale

Variables	OR	95% CI	p
Gender (Female)	1.551	0.830–2.896	0.169
Age	1.129	1.067–1.196	< 0.001
Marital status (widow)	1.317	0.665–2.608	0.429
Level of education	0.995	0.730–1.356	0.974
Health assessment			
average	0.735	0.339–1.595	0.436
good	0.365	0.142–0.938	0.036
Limitation of activity	7.189	3.559–14.522	< 0.001
Problems with vision	1.178	0.549–2.526	0.675
Cognitive problems	1.126	0.611–2.077	0.704
Problems with balance	0.941	0.427–2.076	0.880
Problems with walking	2.153	1.046–4.428	0.037
Arthritis	1.294	0.673–2.489	0.439
Osteoporosis	4.611	1.231–17.265	0.023
Orthostatic hypotension	1.773	0.857–3.665	0.122
Aids	2.431	0.779–7.589	0.126

OR – odds ratio; CI – confidence interval

it explains 36.6% (Cox–Snell  $R^2$ ) and 52% (Nagelkerke  $R^2$ ) of the variance of fall. Unique statistically significant contribution to the model is given by the following variables: age (OR = 1.129,  $p < 0.001$ ), health assessed as good (OR = 0.365;  $p < 0.036$ ), limitation of activities (OR = 7.189;  $p < 0.001$ ), stroke (OR = 2.153;  $p = 0.037$ ), and osteoporosis (OR = 4.611,  $p = 0.023$ ).

By the univariate logistic regression analysis, probability was estimated for sociodemographic factors of falls according to the MFQ scale. The results show that the probability of falling is 4.469 times higher in women (OR = 4.469;  $p < 0.001$ ), and significantly increases with age from 75–80 years to grow almost three-fold (OR = 2.862,  $p = 0.005$ ), as well as in the elderly over 80 years old (OR = 2.628;  $p < 0.001$ ). Participants who live in an urban setting have a 42.8% lower risk of falling compared to those who live in a rural setting (OR = 0.572;  $p = 0.044$ ), as well as those who live in an apartment (OR = 0.375;  $p = 0.009$ ). Participants who have finished more than primary school have a 62.8% lower risk of falling (OR = 0.362;  $p < 0.001$ ). Participants who have assessed their health as average (OR = 0.120;  $p < 0.001$ ) or good (OR = 0.026;  $p < 0.001$ ) are less likely to fall compared to those who have assessed their health as poor.

All analyzed health conditions, except difficulties with balance and with walking, are independent predictors of the risk of falling: limitation of activity (OR = 8.559;  $p < 0.001$ ), vision problems (OR = 60.109;  $p < 0.001$ ), cognitive problems (OR = 9.275;  $p < 0.001$ ), arthritis (OR = 9.302;  $p < 0.001$ ), osteoporosis (OR = 3.573;  $p = 0.037$ ), orthostatic hypotension (OR = 2.949;  $p = 0.004$ ), the use of aids (OR = 24.539;  $p = 0.002$ ), and problems with urination (OR = 3.938;  $p = 0.011$ ).

Multivariate logistic regression analysis was carried out to assess the impact of independent factors, statistically significant compared with falls according to the MFQ scale (Table 4). The entire model with all the predictors is statistically significant ( $\chi^2 = 180.582$ ;  $p < 0.001$ ) and explains

the variance for falling between 36.3% (Cox–Snell  $R^2$ ) and 60.7% (Nagelkerke  $R^2$ ). Unique statistically significant contribution to the model is given by the following variables: female gender (OR = 3.770;  $p = 0.002$ ), health assessed as good (OR = 0.038;  $p < 0.001$ ), limitation of activity (OR = 2.719;  $p = 0.050$ ), vision problems (OR = 2.719;  $p = 0.017$ ), cognitive problems (OR = 4.485;  $p = 0.001$ ), arthritis (OR = 6.524;  $p = 0.001$ ), and problems with urination (OR = 2.511;  $p = 0.032$ ).

## DISCUSSION

A fall can happen to anyone, although older people are more susceptible to falls and injuries caused by falls. As there is a series of risk factors that may cause a fall, a common approach to identify the elderly person in whom these risks are present is needed, after which the determination of specific interventions to be applied in the prevention of falls is required.

In our cross-sectional study, the majority of participants were female. This was in accordance with the data on gender distribution in people aged 65 and older as given by the Statistical Office of the Republic of Serbia [3]. Results of numerous studies indicated that the prevalence of falls was generally higher in women than in men [10, 11, 12]. In our study, we did not find that the female gender was an independent predictor of the risk for fall (according to the results of the EFST). However, we did find that the female gender was an independent predictor in the differentiation of the moderate and high risk for falling (according to the results of the MFQ). These results correspond with some other studies and show that women are three times more likely to fall than men are [10, 11, 12].

Age is one of the key risk factors for falls and the risk of falling increases with age [13]. Another study, which included a large sample of elderly persons, found that probability of falling increased with age [14]. According to some studies that investigated the relationship between falls and risk factors associated with falling, age was in a statistically significant correlation with falling [15]. The frequency of falls increases with age [13, 16]. Our findings are consistent with the results of the aforementioned studies [13, 15, 16]. Subgroups of participants aged 75–79 years and  $\leq 80$  years were at the highest risk of falling.

People aged 65 years and older often have an unrealistic and over-positive assessment of their own health status, which is the reason for risk of falling [17]. This is associated with a tendency of this population to distance themselves from the stereotype of being “old,” which could also mean “powerless.” Although they believe that falling is an important health problem that they need to prevent, they keep their suspicions to a minimum, often supporting the prevention of falls for others but not for themselves [17]. In contrast to the previous studies, the results of our study indicate that those participants who are aged 65 years and older and have evaluated their health as average or good have a lower risk of falling. Such positive perception is a protective risk factor for falling.

**Table 3.** Results of a univariate logistic regression analysis of sociodemographic factors to assess the risk of falling according to the Multi-Factor Falls Questionnaire scale

Variables	Low risk of falling (%)	High risk of falling (%)	OR	95% CI	p	
Gender	[male]	48 (70.6)	116 (34.9)	/	/	/
	female	20 (29.4)	216 (65.1)	4.469	2.532–7.889	< 0.001
Age	[65–69]	23 (33.8)	62 (18.7)	/	/	/
	70–74	19 (27.9)	77 (23.2)	1.503	0.751–3.008	0.249
	75–79	14 (20.6)	108 (32.5)	2.862	1.373–5.963	0.005
	≤ 80	12 (17.6)	85 (25.6)	2.628	1.216–5.680	0.014
Marital status	[married]	52 (76.5)	219 (66.0)	/	/	/
	single	0 (0.0)	1 (0.3)	0.000	0.000–0.000	1.000
	divorced	1 (22.1)	11 (3.3)	2.612	0.330–20.685	0.363
	widow/er	15 (19.3)	101 (30.4)	1.599	0.859–2.975	0.139
Residence	[rural]	24 (35.3)	162 (48.8)	/	/	/
	urban	44 (64.7)	170 (51.2)	0.572	0.333–0.985	0.044
Type of residence	[house]	56 (82.4)	305 (91.9)	/	/	/
	apartment	12 (17.6)	27 (8.1)	0.375	0.180–0.781	0.009
Level of education	[primary school]	32 (47.1)	236 (71.1)	/	/	/
	> primary school	36 (52.9)	96 (28.9)	0.362	0.212–0.616	< 0.001
Number of members	Household	2.51 ± 1.39	2.52 ± 1.54	1.003	0.843–1.192	0.975
Satisfaction with income	[yes]	16 (23.5)	35 (10.5)	/	/	/
	no	46 (67.6)	270 (81.3)	1.130	0.596–2.143	0.707
	partially	6 (8.8)	27 (8.1)	0.800	0.318–2.015	0.636
Health assessment	[poor]	4 (5.9)	151 (45.5)	/	/	/
	average	33 (48.5)	150 (45.2)	0.120	0.042–0.348	< 0.001
	good	31 (45.6)	31 (9.3)	0.026	0.009–0.080	< 0.001
Limitation of activity	[no]	59 (86.8)	144 (43.4)	/	/	/
	yes	9 (13.2)	188 (56.6)	8.559	4.107–17.835	< 0.001
Problems with vision	[no]	67 (98.5)	175 (52.2)	/	/	/
	yes	1 (1.5)	157 (47.3)	60.109	8.247–438.083	< 0.001
Cognitive problems	[no]	55 (80.9)	104 (31.3)	/	/	/
	yes	13 (19.1)	228 (68.7)	9.275	4.855–17.721	< 0.001
Problems with balance	[no]	68 (100.0)	126 (38.0)	/	/	/
	yes	0 (0.0)	206 (62.0)	0.003	0.003–0.004	0.994
Problems with walking	[no]	68 (100.0)	84 (25.3)	/	/	/
	yes	0 (0.0)	248 (74.7)	0.000	0.000–0.000	0.993
Arthritis	[no]	63 (92.6)	191 (57.5)	/	/	/
	yes	5 (7.4)	141 (42.5)	9.302	3.647–23.723	< 0.001

[ ] – reference group; OR – odds ratio; CI – confidence interval

Normal aging is associated with decreased functions of several physiological systems including the muscular, cardiovascular, visual, and vestibular system, as well as proprioception, coordination, slow postural response, and cognitive function [2]. The decline in physiological functions of these systems increases the risk of falling [2, 18]. The change in the function of these systems, i.e. medical conditions, could represent another significant predictor of falling. Many studies have shown that medical conditions such as visual impairment, arthritis, problems with urination, balance disorder, and walking or cognitive status were associated with the risk of falling [19, 20]. Our study confirmed higher risk of falling in participants with activity limitations, vision problems, cognitive problems with balance and walking. We found that the potential risk for falling in those participants who reported vision problems increased thirteen-fold, in those who were restricted in their activities seven-fold, in those with arthritis six-fold, while the risk has increased four-fold in participants with

cognitive problems. In addition, the results of our study have shown that the potential for risk of falling in people with osteoporosis who are aged 65 years and older has increased four-fold. This fact is supported by the evidence in earlier studies. More precisely, osteoporosis associated with impaired balance during physical activity could have psychosocial consequences that could further increase the risk of falling [21]. Elderly individuals have a higher chance to experience a fall if they are trying to overcome an obstacle while walking. However, recent studies have refuted the fact that people with osteoporosis are more unstable in challenging situations [21]. People older than 65 years have an increased chance to suffer a fracture during a fall due to the reduced bone density [22]. It is described that the fear of falling and falling are not directly related, but are a result of the function of the basic mutual risk factors. These factors include sociodemographic factors [23], the history of falls [24], the health status, e.g., arthritis [25], osteoporosis [26], visual problems [27], problems with urination [28], balance

**Table 4.** Results of a multivariate logistic regression analysis to assess the risk of falling according to the Multi-Factor Falls Questionnaire scale

Variables	OR	95% CI	P
Gender (female)	3.770	1.648–8.624	0.002
Age	1.009	0.942–1.081	0.790
Residence	1.209	0.519–2.818	0.660
Place of residence	0.725	0.220–2.394	0.598
Level of education	0.871	0.585–1.297	0.496
Health assessment			
average	0.461	0.128–1.656	0.235
good	0.140	0.036–0.545	0.005
Limitation of activity	2.719	1.002–7.381	0.050
Problems with vision	13.132	1.588–108.581	0.017
Cognitive problems	4.185	1.807–9.691	0.001
Arthritis	6.524	2.077–20.496	0.001
Osteoporosis	2.044	0.314–13.311	0.545
Orthostatic hypotension	1.498	0.537–4.127	0.444
Aids	2.837	0.307–26.235	0.358
Urination	2.511	1.083–5.820	0.032

disorder and stroke [29], cognitive status [30], orthostatic hypotension [31]. Our results confirm these facts and suggest that many fall risk factors are directly responsible for developing the fear of falling [32].

### Strengths of the study

The first strength of our study is a large number of participants. Secondly, we have provided a clear definition of a fall to all participants, which has helped them to differentiate whether a certain event was a fall or not. Finally, another strength of our study lies in the fact that research regarding the risk factors for falls in elderly persons is scarce in our country.

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### Limitations of the study

Our study had several limitations. The first limitation is the fact that we have collected information based on retrospective recalling of the elderly persons – thus, we have relied on their memory. Retrospective data collection for a period of 12 months can be considered a restriction [33]. Secondly, we have relied on subjects to self-report the falls, which were mostly not witnessed – hence, the reliability of these data could be questionable. Results in the literature suggest that retrospective self-report of falls and injuries may be less accurate, mainly due to a lack of reporting [33].

### CONCLUSION

Based on the results observed, we can conclude that the risk of falling in individuals older than 65 years is higher in women, individuals aged 75–79 and over 80 years, individuals who had a limitation of activities, arthritis, osteoporosis, balance disorder, abnormal gait, cognitive problems, problems with vision and urination. The assessment of health status as average or good proved to be a protective factor.

The results could contribute in directing policy and in the planning of public health programs and interventions for the prevention of falls.

### NOTE

This work originated from the doctoral dissertation titled "Fall risk factors and functionality in elderly persons" by Sunčica Ivanović. The dissertation is available at the Faculty of Medicine, University of Novi Sad, Serbia.

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## Идентификација старих особа са ризиком за пад и фактора ризика за пад у општој популацији

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### САЖЕТАК

**Увод/Циљ** Циљ овог истраживања био је да се идентификују старе особе са повећаним ризиком за пад и фактори ризика за пад у општој популацији.

**Метод** У студију пресека укључено је 400 особа (164 мушкарца и 236 жена) просечне старости 75,04 (65–94) година које су одабране насумично из регистра Дома здравља Ниш, у периоду јануар–јун 2014. За добијање података коришћени су социо-демографски упитник, скрининг тест за пад код старих особа и упитник за процену више фактора ризика за пад. Однос преваленција (*OR*) процењена је и прилагођена за пол и године старости, брачно стање, степен образовања и самопроцену здравственог стања помоћу вишеструке регресионе анализе.

**Резултати** Ризик за пад и фактори ризика за пад су старост (*OR* = 1,129; *CI* = 1,067–1,196), особе које добро процењују своје здравље (*OR* = 0,365; *CI* = 0,142–0,938), ограничење активности (*OR* = 7,189; *CI* = 3,559–14,522), проблеми са ходом (*OR* = 2,153; *CI* = 1,046–4,428), остеопороза (*OR* = 4,611; *CI* = 1,231–17,265), женски пол (*OR* = 3,770; *CI* = 1,648–8,624), проблеми са видом (*OR* = 2,719; *CI* = 1,588–108,581), когнитивни проблеми (*OR* = 4,485; *CI* = 17,721), артритис (*OR* = 6,524; *CI* = 2,077–20,496) и проблеми са мокрењем (*OR* = 2,511; *CI* = 1,083–5,820).

**Закључак** Фактори ризика за пад су старост, лична процена здравља, проблеми са ходом, остеопороза, женски пол, проблеми са видом, артритис, проблеми са мокрењем.

**Кључне речи:** старе особе; ризик за пад, фактори, процена; општа популација