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Most common risk factors of falls in the elderly population

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Abstract
Introduction: The elderly population ages more quickly in comparison with general population, resulting in a larger number of falls.
Aim: The aim of the paper is to investigate the risk factors of falls in the elderly population who seek treatment at the Banja Luka Family Health Center dispensaries.
Methods: The research is actually a prospective cohort study covering March 20 - May 20 2016 periods. The study encompassed patients aged 65+ who sought treatment at the Banja Luka Family Health Center dispensaries. The patients were interviewed and data from both electronic and register charts were used. The data collection instrument was a general questionnaire covering social-demographic information as well as the Tinetti Gait and Balance instrument.
Results: The research covered 208 patients aged 65+, i.e. 81 males (38.9%) and 127 females (61.1%). The results indicated a significant statistical connection between the age ($p = 0.000$), physical activity ($p = 0.000$), number of patient's household members ($p = 0.006$) and patient's level of education ($p = 0.000$) on one side and the risk of falls in the elderly population on the other side. In addition, the results specified that the sex ($p = 0.170$) and the nutrition degree ($p = 0.477$) had no statistically relevant impact on the risk of falls.
Conclusion: As the elderly population and their number of injuries and falls are increasing worldwide, it is crucial to pay attention to our senior population, identify their risks of falls, and design prevention measures in order to avoid injuries and consequences. Hence, family doctors play a pertinent role.

Keywords: the elderly, risk of falls, life habits, family doctor

Introduction

Aging is a life-long process. As the time passes, the muscle percentage and strength fade and result in poor condition. Furthermore, aging causes weakening of myocardial contractility and our mental abilities become poorer. Nowadays, there is no generally accepted theory of aging [1]. Most developed countries have adopted a definition according to which the elderly population covers people aged 65+ [2].

When compared with the general population, the elderly population is in expansion. The ratio of seniors grew from 9.2% of general population in 1990 up to 11.7% in 2013.The expected ratio in 2050 is 21.15%. The elderly population is dominated by female seniors [3].

The increase of the elderly population affects the number of falls among them. It is more than one third of seniors aged 65+ that fall every year and more than half of the falls tend to repeat [4].

The causes of falls may be either internal or external. The internal causes are in connection with the patient and these are as follows: blood pressure decrease, disturbance of cardiac conduction, vertigo, disorder of senses, mental disorders, and motion difficulties (rheumatic diseases and muscle weakness). The external factors are those depending on housing conditions and environment (causing around 50% of total falls) and factors rising from unwanted side effects of medications [1].

Dementia, delirium, and other psychological diseases result in bad judgement, disturbance of attention, confusion, hallucination, changes in functions, and social isolation. Musculoskeletal disorders cause falls along with deformity, pain, inflexibility and walk disturbance. First symptoms of an acute disease in the elderly may manifest through weakness, confusion and fall. Genitourinary infections and incontinationcause the urge to urinate, which improves the risk of falls [5, 6, 7].

Common physiological changes in senior age are visual impairment, reduced accommodation, presbyopia, and decreased visual field. Common problems are the impaired distance perception, presbiacusia and poor spatial orientation. Additionally, time to react is reduced, attempts to rise are difficult, and touch sensibility is decreased [1].

We should not neglect psychological issues such as anxiety and depression. The patient is in fear of falling again, which may result in reduced rising and moving [8, 9]. Recently, a term cautious gait has been used to designate motion of the elderly characterized with decreased walk speed, shorter strides, poor arm movement, the shuffling and turning trunk in "a block", all of which results from different neurological, musculoskeletal and system disorders [5, 10].

The slower and poorer vital functions and the body susceptible to disease and injuries are typical of the senior age. It is the aim of modern medicine to minimize frequency of disease and injuries in elderly patients so they may spend their old age in dignity.

AIM of the paper

The aim of the paper is to investigate the risk factors of falls in

the elderly population who seek treatment at the Banja Luka Family Health Center dispensaries.

Methodology

Having gained approval from the Ethical board of the Banja Luka Family Health Center, the research was conducted as a prospective study for March 20 – May 20, 2016 periods. The patients were interviewed and data from both electronic and register charts were used. Patients aged 65+, who were treated at the Banja Luka Family Health Center dispensaries, participated in the research. All patients were introduced the scope and aim of the study and they provided the written consent. The 208 patients were randomly selected from the register of six teams of the Banja Luka Family Health Center. Every second patient aged 65+ was selected regardless of sex. Having taken anamnestic data, we had an insight into whether the patient had suffered from a fall over the last five years and whether the fall had resulted in fractions. All patients were taken anthropometric measurements, measured for blood pressure and had their Body Mass Index (BMI) calculated. The research fully complied with the Declaration of Helsinki on Ethnical Principles for Medical Research and Good Scientific Practice.

For the purpose of statistical processing, four groups of patients were singled out in line with age and the groups covered five-year periods.

The following instruments were used for data collection: the general questionnaire covering social-demographic information, information on housing conditions, level of education, marital status, chronical disease, therapy used by the patients, life habits, physical activity, and the Tinetti Gait and Balance Instrument [11] which was designed to determine the risk of fall in elderly patients in the following year. As we used this questionnaire, we performed a physical examination of all patients and determined their balance for which we calculated a separate score and we evaluated the patients' gait and calculated another score, all of which resulted in a final score to help us assess the risk of fall for each patient in the following year.

Statistical processing and data analysis

Data from the questionnaires were entered into the Excel database and statistically processed. The results were analyzed at several levels by using SPSS 11.5 program. The following statistical procedure was used in data processing: the descriptive analysis of frequency and percentage of individual responses within the patient sample. Differences among categories of examinees (age, sex, number of household members, level of education, etc.) at the risk of fall were analyzed by using Chi square test. T-test was used to compare mean values for two groups of examinees. In all applied analytical methods, the level of significance was 0.05 and 0.01.

Results

The study encompassed 208 patients aged 65+, i.e. 81 (38.9%) males and 127 (61.1%) females. The average age of the examinees was 73.7 years. Most patients were aged 65 to 70 (76 (36.5%)), and there were 31 (14.9%) patients aged 81+. Most examinees were married (127 (61.1%)) and 73 (35.1%) patients were widowers. In addition, 172 (82.7%) patients lived in city and 121 lived in a house (58.2%). Also, 57 (27.4%) patients lived alone, 87 (41.8%) lived with a spouse, and one third of patients lived in families of three or more members. Most households (180 (86.5%)) had no children under the age of 18. The majority of patients (84 (40.4%)) graduated from high school, 15 (7.2%) patients had no school completed, and only 12 (5.8%) patients graduated from college. Besides, the majority of patients were retired persons - 190 (91.3 %) (Table 1).

Table 1: Social-demographic patient data

Variables	Examinees N (%)		Variables	Examinees N (%)
Sex			***Number of people in household***	
Male	81 (38.9)		One person	57 (27.4)
Female	127 (61.1)		Two people	87 (41.8)
Age			Three or more people	64 (30.8)
65-70	76 (36.5)		***Number of children in household***	
71-75	56 (26.9)		No children	180 (86.5)
76-80	45 (21.6)		One child	14 (6.7)
≥ 81	31 (14.9)		Two children	13 (6.3)
Marital status			Three children	1 (0.5)
Married	127 (61.1)		***Education level***	
Single	5 (2.4)		No school	15 (7.2)
Divorced	3 (1.4)		Four-grade elementary school	25 (12.0)
Widowed	73 (35.1)		Eight-grade elementary school	44 (21.2)
Place of living			High school	84 (40.4)
Countryside	36 (17.3)		College degree	28 (13.5)
City	172 (82.7)		Academic degree	12 (5.8)
Housing			***Occupation***	
Building apartment	87 (41.8)		Farmer	4 (1.9)
House	121 (58.2)		Unemployed	14 (6.7)
			Retired person	190 (91.3)

Our group of examinees covered most non-smokers, i.e. 141 (67.8%), 46 (22.1%) were former smokers, and 21 (10.1%) were active smokers. One person declared to take alcohol on daily basis, 43 (20.7%) patients took alcohol occasionally, and 164 (78.8%) never consummated alcohol. Most our examinees (155 (74.5%)) daily drank one or two cups of coffee, 27 (13.0%) took more than two cups on daily basis, and 26 (12.5%) never consummated coffee. More than half examinees

were physically inactive (110 (52.9%)), i.e. they were active less than one hour daily, 65 (31.3%) patients were active one to three hours per day, and 33 (15.9%) were active more than three hours a day (Table 2).

Table 2: Patients' life habits

Variables	Examinees N (%)
Smoking habits	
Non-smoker	141 (67.8)
Former smoker	46 (22.1)
Smoker	21 (10.1)
Alcoholconsumption	
Yes	1 (0.5)
No	164 (78.8)
Occasional	43 (20.7)
Daily coffee consumption	
1-2 cups	155 (74.5)
More than 2 cups	27 (13.0)
Does not drink coffee	26 (12.5)
Physical activity (weekly hours)	
0-7	110 (52.9)
8-21	65 (31.3)
> 22	33 (15.9)

According to the nutrition level, 41 (19.7%) patients had normal body mass, i.e. their BMI was lower than 25.0 kg/m^2 (BMI < 25.0 kg/m^2), 96 (46.2%) patients were in the pre-corpulence category (BMI= 25.0-29.99 kg/m^2), and one third were corpulent (BMI ≥ 30.0 kg/m^2).

Having used the Tinetti gait and balance instrumentto evaluate the gait and balance, we inferred that one third of patients were highly risky of falling (63 (30.3%), 35 (16.8%) patients were in the moderate risk category, and 110 (52.9%) patients were in the low risk group (Table 3).

Table 3: Risk of fall evaluation (*Tinetti gait and balance instrument*)

Risk of fall	Examinees N (%)
High risk	63 (30.3)
Moderate risk	35 (16.8)
Low risk	110 (52.9)

Over the past five years, 110 (52.9%) patients did not suffer from a fall and 98 (47.1%) patients experienced one or more falls. Those patients who encountered different falls most commonly used the following medicaments: ACE inhibitors in 69 (70.4%) patients, NSAIL in 41 (41.8%) patients, benzodiazepinesin 36 (36.7%) patients, beta-blockersin 30 (30.6%) patients, ACE inhibitors combined with diuretics in 29 (29.6%) patients and calcium channel blockers in 28 (28.6%) patients.

Results of our study indicate a statistical relevance (p = 0.000) for the growing risk of fall depending on age. Namely, the risk of fall increases with age. Among all the examinees, one third of them were assessed as being at high risk of falling and patients aged 81+ were at the highest risk (20 (64.5%)). On the other hand, the youngest patients were at the lowest risk category (11 (14.5%)). Out of 110 (52.9%) patients from the low risk category, 56 (73.7%) were aged 65 to 70, and 7 (22.6%) were aged 81 + (Table 4).

Table 4: Impact of age on the risk of fall

Risk of fall	Age				Total N (%)	χ^2 test	p
	65-70 N (%)	71-75 N (%)	76-80 N (%)	≥ 81 N (%)			
High	11 (14.5)	15 (26.8)	17 (37.8)	20 (64.5)	63 (30.3)	37.577	0.000
Moderate	9 (11.8)	10 (17.9)	12 (26.7)	4 (12.9)	35 (16.8)		
Low	56 (73.7)	31 (55.4)	16 (35.6)	7 (22.6)	110 (52.9)		

Results also indicate that the sex has no statistically relevant impact on the risk of fall (p = 0.170). It was 63 (30.3%) of our examinees that were in the high risk category. In addition, 19 (23.5%) of those were male and 44 (34.6%) were female (Table 5).

Table 5: Impact of sex on the risk of fall

Risk of fall	Sex		Total N (%)	χ^2 test	p
	Male N (%)	Female N (%)			
High	19 (23.5)	44 (34.6)	63 (30.3)	3.544	0.170
Moderate	13 (16.0)	22 (17.3)	35 (16.8)		
Low	49 (60.5)	61 (48.0)	110 (52.9)		

Results indicate that the nutrition level has no statistically relevant impact on the risk of fall (p = 0.477). Out of 63 (30.3%) patients who were at a high risk of falling, 24 (33.8%) were corpulent. Furthermore, 27 (28.1%) patients were pre-corpulent and 12 (29.3%) had a regular body mass (Table6).

Table 6: Impact of nutrition level on the risk of fall

Risk of fall	Body Mass Index (kg/m^2)			Total N(%)	χ^2 test	p
	<24.99 N(%)	25-29.99 N(%)	≥ 30 N(%)			
High	12 (29.3)	27 (28.1)	24 (33.8)	63 (30.3)	3.506	0.477
Moderate	10 (24.4)	13 (13.5)	12 (16.9)	35 (16.8)		
Low	19 (46.3)	56 (58.3)	35 (49.3)	110 (52.9)		

Out of one third of high risk patients, most were in the poor physical activity category (50 (45.5%)), which meant they were active less than one hour per day. In addition, 11 (16.9%) patients were active one to three hours per day and fewest of them were active more than three hours on daily basis (2 (6.1%)).As the daily physical activity increases, the risk of fall is less statistically relevant (p = 0.000) (Table 7).

Table 7: Impact of physical activity on the risk of fall

Risk of fall	Physical activity (weekly hours)			Total N(%)	χ^2 test	p
	0-7 N (%)	8-21 N(%)	>22 N(%)			
High	50 (45.5)	11 (16.9)	2 (6.1)	63 (30.3)	30.165	0.000
Moderate	16 (14.5)	15 (23.1)	4 (12.1)	35 (16.8)		
Low	44 (40.0)	39 (60.0)	27 (81.8)	110 (52.9)		

Our results further indicate a statistically significant connection (p = 0.006) between the number of household members and the patients' risk of fall. Two or more members who share household with the patient designate a higher risk of fall in comparison with the patients living alone (Table 8).

Table 8: Impact of household members on the risk of fall

Risk of fall	Number of household members		χ^2 test	p
	Single	Two or more members		
High	23 (36.5)	40 (63.5)	10.119	0.006
Moderate	14 (40.0)	21 (60.0)		
Low	20 (18.2)	90 (81.8.0)		

The level of education has a large impact on the risk of fall (p = 0.000). Among the high risk patients, 39 (61.9%)have no education or they completed elementary school, 17 (27.0%)patients graduated from high school, and seven patients has an academic degree(Table 9).

Table 9: Impact of level of education on the risk of fall

Risk of fall	Level of education			χ^2 test	p
	Elementary school or less	High school	College and faculty		
High	39 (61.9)	17 (27.0)	7 (11.1)	20.928	0.000
Moderate	15 (42.9)	15 (42.9)	5 (14.3)		
Low	30 (27.3)	52 (47.3)	28 (25.5)		

Discussion

Having used the Tinetti gait and balance instrument for the evaluation of walk and balance, we noticed that one third of all our examinees were in a high risk of fall as already indicated by some former studies. Kamel *et al.* [12] conducted a study in Urban Suez- Egypt and discovered that 205 (60.3%) of total 340 patients had experienced at least one fall in a year.

Results of our research indicate that corpulence is not statistically relevant and has poor impact on the risk of fall in our patients.

A 2012 prospective analytical study conducted by Matović *et al.* [13] with 300 patients aged 70+ registered at dispensaries at the Foča Health Center detected pre-corpulence in 42.3% and corpulence in 20.8% examinees.

Our study discovered that age largely affected the risk of fall (p = 0.000). The risk of fall increases with age so that patients aged 81+ were in the highest risk (64.5%), whereas patients aged 65-70 were in the lowest risk category.

Kamel *et al.* [12] pointed out that age greatly affected the risk of fall. Their study discovered that 15.0% patients aged 70+ had experienced at least one fall in comparison with 5.2% patients from the same category who had experienced no falls. Furthermore, Stanetić *et al.* [14] also determined a significant connection between age and risk of fall. Alexander X. Lo *et al.* [15] conducted a study on 970 patients aged 65+ in five Alabama states and also ascertained a significant correlation between age and risk of fall.

Our study determined no correlation between sex and nutrition level on one side and the risk of fall on the other. Kamel *et al.* [12] carried out a study on 340 Egyptian patients and discovered that most falls were suffered by females, which might be accounted for by the fact that most examinees within their sample were women (63.2 %).

Stanetić *et al.* [14] conducted a 2102 study at the Banja Luka Health Center and the findings showed that females aged 65+ were at the highest risk of fall.

According to our findings, physical activity is statistically relevant to the risk of fall (p = 0.000), which had also been corroborated by other studies. Out of one third of the high risk patients, the least physically active patients were in highest risk (50 (45.5%)), i.e. the patients who were physically active less than an hour per day when compared with those patients who were physically active more than three hours per day and were in lowest risk (2 (6.1%).

Dubljanin-Raspopović *et al.* conducted a study at the Clinic for Orthopaedic Surgery, Clinical Center of Serbia, with 342 patients aged 65+ who were hospitalized for the acute hip fracture upon minor trauma. Their analysis inferred that more than half examinees had low index of activities of daily living [16].

Kamiska *et al.* conducted a study in north-west Poland with 304 patients aged 65-100 who used services of the *West Pomeranian Prevention and Therapy Centre in Szczecin* regional center. Their study showed that there was a

statistically relevant correlation between physical activities and the risk of fall. The examinees that had experienced falls were poorly able to perform daily activities [17].

In addition, Kamel *et al.* [12] discovered a statistically relevant correlation between physical activity and the risk of fall. Among 340 patients, most did not apply regular daily physical activity and were in a high risk of fall unlike the examinees that were constantly physically active and were in far lower risk of fall.

The connection between physical activity and the risk of fall was also confirmed in studies conducted by Abdulmajeeda *et al.* [18] and Mancini *et al.* [19].

The American Geriatrics Society, The British Geriatrics Society, and the American Academy of Orthopaedic Surgeons confirmed that the poor physical abilities and increase of daily activities were the most common causes of falls [20].

Alexander Lo *et al.* [15] also inferred that the decrease of physical abilities and activities, as well as the fear of fall, largely affected the risk of fall in the elderly.

Our findings also indicate a statistically relevant connection ($p = 0.006$) between the number of household members and the patient's risk of fall. This connection implies that patients living in a household with two or more members are at higher risk of fall when compared with patients living alone.

Kamel *et al.* [12] pointed out that more than half their examinees lived with families and around 16.2% lived alone, which further affected their risk of fall. Furthermore, 12.0% of total examinees who lived alone (16.2%) experienced a fall, which greatly differed from 4.2% patients who experienced no falls. Both Abdulmajeeda *et al.* [18] and Petrido *et al.* [21] found no significant correlation between patients living alone and the risk of fall. Other studies, such as the one conducted by Reyes-Ortiz *et al.* in Mexico, confirmed a higher risk in patients living alone per 20-30% [22].

Our study discovered that the level of education largely affected the risk of fall ($p = 0.000$). Out of 63 high-risk patients, 39 (61.9%) completed only elementary school.

Kamel *et al.* [12] suggested that around one third of their patients who had experienced falls were illiterate and they found no statistically relevant impact of education level on the fall in their examinees. Their results were in concordance with those of Reyesa-Ortiza *et al.* [22]. In addition, studies conducted in America suggested that the level of education largely affected the risk of fall in the elderly patients [23].

The falls have both social and personal consequences in the elderly. Each fall results in the necessary health care, including medical treatments and long-term rehabilitation. Individually, the patient's quality of life is impaired, the movements are poor, the patient cannot take care of himself/herself and becomes dependent on someone else's assistance, the regular activities change, and, finally, the patient grows fear of a repeated fall resulting in anxiety and depression. Studies have shown that the fear of fall is correlated with negative health consequences such as the repeated fall, reduction of physical activity, avoidance of social activities and occurrence of depression [24].

Conclusion

Results of our study indicate that age, physical activity, number of household members, and level of education have a significant statistical impact on the risk of fall in senior patients. Sex and level of nutrition have no statistically relevant impact on the risk of fall in the elderly patients.

Although senior patients are exposed to different risks of fall, there are many risk factors that might be prevented and these are as follows: eyesight impairment, osteoporosis, medicament usage, physical inactivity, smoking habits, alcohol consumption, uncontrolled body mass, environment, housing conditions, etc.

As the number of senior patients and their falls and injuries increase worldwide, it is crucial to pay attention to the elderly, identify their risks of fall, and finally prevent the injuries and consequences. Hereby, family doctors play a pertinent role.

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