ORIGINAL ARTICLE

Falls and associated factors among older workers in a university

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ABSTRACT

Objective: To analyze factors associated with falls among older workers in a public university. **Methods:** Cross-sectional study, with workers aged 60 or more. A structured questionnaire was used to cover socio-demographic and occupational characteristics and the occurrence of falls over the last 12 months. Instruments used: Geriatric Depression Scale, Pittsburgh Sleep Quality Index, International Physical Activity Questionnaire, Timed Up and Go Test (TUG), Sitting-Rising Test (SRT), Gait Speed, Static Balance, and Grip strength. **Results:** The study included 254 older workers, 76% belonged to the age group between 60-64 years and 58.7% were male. The sample was divided into two groups, fallers and non-fallers, and the prevalence of falls over the last twelve months was 21.3% ± 2.72 (95% CI = 15.92-26.58). There was a significant association between falls and gender (p = 0.043), hospitalization over the last 12 months (p = 0.000), and gait speed (p = 0.007). In the Poisson regression model the three variables remained associated with falling: male gender (PRaj = 0.62, CI = 95% 0.40-0.98); suitable gait speed (PRaj = 0.46, CI = 95% 0.26-0.81), and hospitalization over the last 12 months (PRaj = 2.79, CI = 95% 1.80-4.32). **Conclusion:** The study identified a lower prevalence of falls in this group and found a positive relationship between work and the aging process, which proves that seniors who keep on working are healthier than the general population of the elderly.

Keywords: Accidental Falls, Workers, Aged, Health Status

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INTRODUCTION

The aging of the population today is part of the reality of most societies[1] and, according to projections, in 2025 Brazil will be the world's sixth most populous country in terms of elderly people, reaching about 34 million or 15.1% of the population.[2] With the increase of elderly people who are still productive, they form a higher percentage of the labor market than other countries due to their continuing to work after reaching retirement age.[3]

According to Furtado,[4] 46% of the elderly males participate in the labor force in Brazil, which still falls short of countries like Mexico and Iceland, which recorded levels above 50% and 60%, respectively, surpassing those observed in several developed countries like the United States, France, Germany, Canada and Japan. With the exception of Japan, these countries had rates below 30%.[4]

This not only shows an increasing contingent of elderly in Brazil, but also their importance in the economy. According to IBGE, in 1977 the elderly corresponded to 4.5% of the Economically Active Population (EAP); in 1998 it reached 9% and may represent 13% of the EAP by 2020.[5] According to Giatti,[6] there is a strong association of work with better indicators of autonomy and physical mobility, even after adjusting for age and other sociodemographic factors.

Several studies[4,6-9] have shown that people who work have better health conditions than the general population and that maintaining an active life seems strongly determined by one's physical capacity.[6] As such, in view of the importance of the elderly work force to overcome problems in the social security system and, at the same time, of the benefits that it can bring to the health of the elderly population, this study is relevant because it brings to the discussion the relationship between aging, working, and falling.

No studies related to falls among the elderly workers were found in the literature, the study of falls being of great importance in this specific population, in which falling could be considered a limiting factor in their remaining or re-integrating into the labor market.

OBJECTIVE

In this context, the objective of this study was to examine factors associated with falls among elderly workers in a public university.

METHODS

This is a cross-sectional study, observational and exploratory, with the elderly workers at the *Universidade Estadual de Londrina* (UEL), PR, Brazil. After the authorization of the institution's Dean of Human Resources, those considered eligible for inclusion in the study were all workers aged 60 or over, working in different centers and sectors of the institution, regardless of the type of occupational activity and without distinction of gender, race, or social class.

The sample was estimated at 240 participants, considering a prevalence of 11.3% of individuals above 60 years of age in the Brazilian population, with an estimated error of 4%.[10] The formula used was $E=\alpha.\sqrt{(p.q)/n}$. The study included 254 elderly people, as a flow chart (Figure 1), which illustrates the recruitment and sample loss of elderly participants in this study.

Exclusion criteria included the elderly with cognitive alterations that were detectable by the Mini Mental State Examination (MMSE), score lower than the score limit for their level of education,[11] refusal, workers off work for more than 15 days during the collection period (sick leave, special leave, training leave, and retirement leave), death, physical incapacity to perform the functional physical tests such as amputation of limbs, use of a wheel chair, limiting deformity, serious sequelae of a stroke, or serious or unstable Parkinson disease, workers with a speech or hearing impairment that would hamper the interview, and those who at the moment of contact were retired.

The participants were contacted by telephone or in person at the workplace, and previously informed about the objectives of the study. The research received the approval of the Ethics and Research Involving Human Subjects of the UEL under Nº 107/2013 and protocol CAAE 17813713.5.0000.5231. The participants were told about the research and signed the Informed Consent Form.

Evaluation instruments

There was a previous pilot study conducted with 30 elderly workers with no ties to the UEL, in order to adjust the data collection

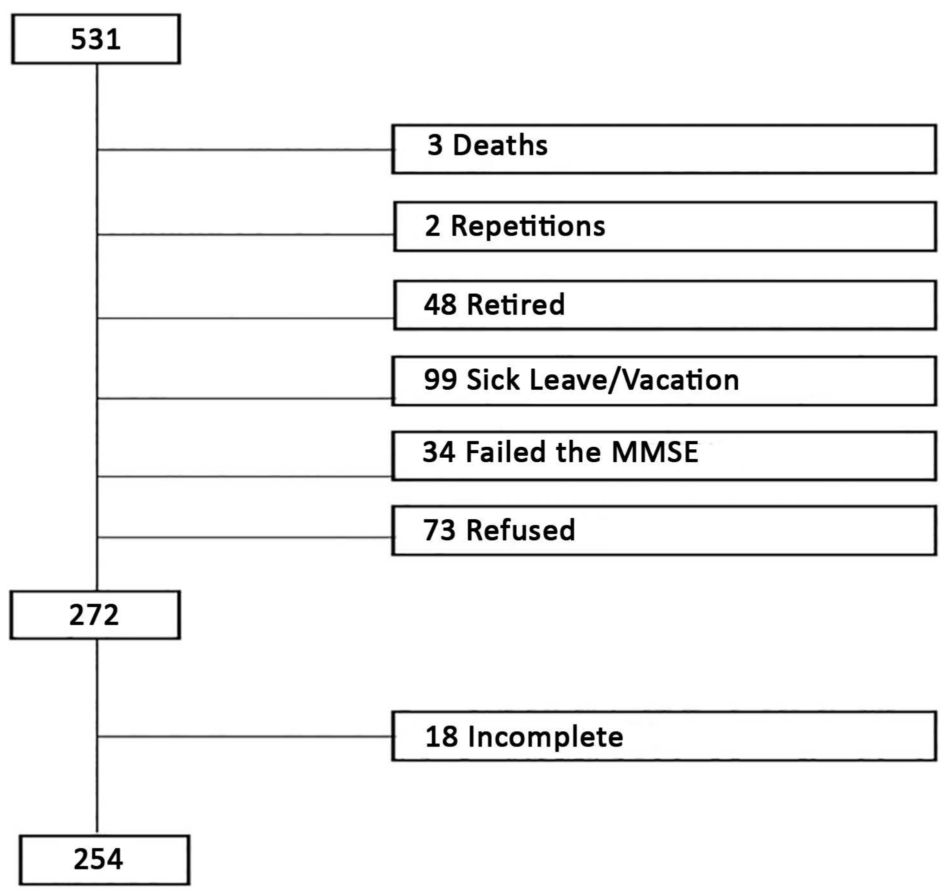

Figure 1. Flow diagram of the Sample

instruments. Six researchers participated in the collection: four undergraduate students in health and two graduate students-all were previously trained. The data collection occurred in the period between August 2013 and August 2014 in the workplace itself or in a commonly used room, according to the convenience of the worker.

A structured questionnaire was applied in an interview addressing sociodemographic aspects (gender, age, occupation, marital status, education, family income) and occupational aspects (working time, requirement of the job, and work load) and the occurrence of falls in the last 12 months.

In relation to the health status, the Geriatric Depression Scale - short version (GDS -15) was used as well as the Pittsburgh Sleep Quality Index (PSQI), Body Mass Index (BMI), the use of medicines, hospitalization in the last 12 months, whether they live alone, perceived health, and the International Physical Activity Questionnaire (IPAQ). To evaluate their functional performance (strength of the lower and upper limbs, mobility, and balance) we used the Timed Up and Go Test (TUG), "Sitting and Rising" (SR) from a chair 5 times, gait speed (GS) 4.6 meters, Static balance, and Handgrip Strength (HGS).

The MMSE, adapted to the Brazilian population by Bertolucci[11] is an instrument consisting of six items that assess specific cognitive functions, such as temporal and spatial orientation, registration, attention and calculation, recall of evocation, and language. The MMSE score can range from a minimum of zero to a maximum of 30 points. To be considered for the absence of cognitive disorders, the cutoff points were: 13 or more for illiterate people; 18 or more for those with 1 to 7 years of schooling; and more than 26 points for 8 or more years of schooling.[11]

The Brazilian validation of the short version of the GDS-15 was performed by Almeida and Almeida;[12] it is an instrument that provides valid and reliable measurements for the assessment of depressive disorders, in which there are 15 questions with the cut-off point being 5/6 (no/yes), with a sensitivity rate of 85.4% and specificity of 73.9% for the diagnosis of depressive episodes. The issue of job demands (mental, physical, or both) was adapted from the second item consisting in the Work Ability Index (WAI).[13] This instrument allows us to evaluate the working ability based on the perceptions of the worker himself.

The PSQI prepared by Buysse et al.[14] evaluates the quality of sleep compared to the previous month, providing an index of severity and nature of the disorder, or a combination of quantitative and qualitative information on sleep. It is composed of seven components: C1 subjective quality of sleep; C2 sleep latency; C3 duration of sleep; C4 habitual sleep efficiency; C5 sleep disorders; C6 use of sleep medication, and C7 inherent to sleepiness. The total maximum score of this instrument is 21 points, with scores above five points indicative of poor quality in sleep patterns.[14]

In relation to anthropometric assessment, the BMI was classified as normal weight (< 27.0 kg/m²) and overweight (> 27.0 kg/m²) according to the specific cut-off points for elderly proposed by Lipschitz.[15] THE IPAQ in its short version was used to measure the level of physical activity, following the standardized guidelines of the instrument and for purposes of the categorized analysis as active (very active/active) and a sedentary lifestyle (sporadically active/sedentary).[16]

The assessment of functional mobility was estimated by means of the mean of two measurements in the TUG test. As a standard, the subjects were sitting in a standard chair 45 cm in height, instructed to get up from the chair without the support of the arms, to walk three meters, turn 180° around, and return to a sitting position at normal speed. The results allow to classify the elderly in: independent and with a low risk of falls (tested time shorter than 10 seconds), semi-independent and with medium risk for falls (between 10.1 and 20 seconds), and somewhat independent, with a high risk of falls (greater than 20 seconds), and with compromised mobility.[17]

Static balance was evaluated in three positions (tandem stand, semi-tandem stand, and side-by-side), adapted from the Short Physical Performance Battery - SPPB.[18] The participant was instructed to remain in each position for ten seconds, with eyes closed in the position of feet together, followed by with one foot partially ahead (eyes open), and with one foot ahead (eyes open).

The SR test from a chair five times is considered a valid and reliable indicator to check the strength of the lower limbs.[19] They were asked stand up and sit down in the chair five times, at the highest possible speed (measuring time spent in seconds). For the calculation the cutoff point, it was adopted what was proposed by Guralnik and Winograd[18]. THE HGS was evaluated by means of a dynamometer type JAMAR, using the dominant hand, three measurements were taken for kg/strength (kg/s), and the average value considered with an interval of 60 seconds of rest between one measurement and the next, with reference values by Barbosa et al.[21]

The GS was calculated by means of the time spent to go 4.6 meters at a comfortable speed. Only one measurement was taken and the adopted cutoff points were adjusted for gender and height, as proposed by Fried et al.[20]

Data Analysis

The data collected were transcribed onto a custom form, subsequently tabulated by two independent researchers and were then submitted to information mirroring in order to minimize inconsistencies. The files created were compared by using Epi Info®, version 3.5.1 software and the data discrepancies were corrected after consulting the forms. All variables were subjected to Kolmogorov-Smirnov test to verify the normality of the data distribution.

The data were summarized by absolute and relative frequencies and presented in tables. The univariate analysis of the association between variables and groups of fallers and non-fallers was performed using the chi-square (χ^2) test. The multivariate analysis used the Poisson regression with robust adjustment. Significant associations were defined by $p \leq 0.05$ and the programs used were the Epi Info® version 3.3.2 and the Medcalc version 9.3.2.0.

RESULTS

The study population consisted of 254 elderly workers, with a predominance of male 149 (58.7%) and mean age of 62 years, ranging from 60 to 69 years, 155 (61%) with partners, and 148 (58.3%) with undergraduate and graduate education. A total of 244 (96.1%) worked more than 30 hours per week, as can be seen in Table 1.

Almost all the older workers analyzed considered their health from good to excellent quality and also showed no symptoms of depression. More than half the population was considered active and the frequency of hospitalization in the last 12 months was low (Table 2). In relation to their physical-functional conditions, more than half of the sample presented appropriate values for all tests (Table 3).

The sample was divided into two groups of those who fall and those who do not and the prevalence of falls over the last 12 months was 21.3% ± 2.72 (CI 95% = 15.92-26.58).

Table 1. Characterization of the participants, according to sociodemographic variables and occupational characteristics, Londrina, 2015

Variables	Overall/Total participant		Fallers		Non-fallers		*p*
	N	%	N	%	N	%	
Age							
60 to 64 years	193	76	36	18.7	157	81.3	0.071
65 to 69 years	61	24	18	28.5	43	70.5	
Gender							
Male	149	58.7	24	16.1	125	83.9	0.017*
Female	105	41.3	30	28.6	75	71.4	
Marital status							
With a partner	155	61	28	18.1	127	81.9	0.119
Without a partner	99	39	26	26.3	73	73.7	
Education							
High School	106	41.7	26	24.5	80	75.5	0.281
College	148	58.3	28	18.9	120	81.1	
Income							
Up to 4 MMS	104	40.9	26	25	78	75	0.225
5 or more MMS	150	59.1	28	18.7	122	81.3	
Working Demands							
Mental	161	63.4	3	20.5	128	79.5	0.915
Physical	72	28.3	16	22.2	56	77.8	
Both	21	8.3	5	23.8	16	76.2	
Workload							
Less than 30h/week	10	3.9	3	30	7	70	0.491
More than 30h/week	244	96.1	51	20.9	193	79.1	
Time working							
Less than 27 years	129	50.8	33	25.6	96	74.4	0.087
More than 27 years	125	49.2	21	16.8	104	83.2	

MMS: Minimum monthly salary; *p*: test χ^2 Pearson; * $p < 0.05$

There was a significant association between the dependent variable (fall) and the independent variables: gender ($p = 0.043$), hospitalization in the last 12 months ($p = 0.000$), and gait speed ($p = 0.007$).

But the three variables remained associated with falls in the Poisson regression model (Table 4): being male (PRaj = 0.62 CI 95% 0.40-0.98); adequate gait speed (PRaj = 0.46 CI 95% 0.26-0.81), and hospitalization in the last 12 months (PRaj = 2.79 CI 95% 1.80-4.32).

DISCUSSION

The high prevalence of falls among the elderly has been arousing interest in the scientific community for some time. There is extensive literature on the prevalence of falls and its associated factors among elderly people living in the community,[22-25] institutionalized,[26] hospitalized,[27] weakened,[20] and those who are physically active,[28-29] among others. But there is a paucity of studies on the population of elderly workers.

The prevalence of falls in the studied population was 21.3% and this is lower than what is found in national studies[22,23] and 24 different international studies on elderly people who are not workers. However, a similar result was observed in a study conducted using data from SABE research (n = 9,765) and H-EPESE - Hispanic Established Populations for Epidemiologic Studies of the Elderly (n = 1,483), the prevalence of falls, between the cities participating in this study, ranged from 21.6% in Bridgetown, Barbados, to 34.0% in Santiago, Chile.[24]

In a cohort study conducted in São Paulo (SP), 31% of the subjects over 65 suffered a fall in the previous year.[22] Siqueira et al.,[23] found a prevalence of 27.6% in their study on a sample of 6,616 elderly residents of urban areas of 100 municipalities in 23 Brazilian states. The results found in the present study have a similar sample to other studies[22-25] regarding the age range, but differ in relation to the particularity of these elderly because they are workers.

Allowing an inference in relation to work, to what extent can work be seen as a protective factor for falls? Further studies are necessary, due to the scarcity of studies addressing this topic. What can be argued is that, based on studies related to the prevalence of falls and the estimation by the Ministry of Health of 30%, the elderly who are inserted into the labor market analyzed had a percentage of falls lower than expected for their age.

In the present study there was a predominance of males (58.7%), but this distribution is not in agreement with studies of the community, in which women were seen to have greater longevity; this phenomenon is known as the feminization of old age.[30] This fact can be explained by more than half of the elderly males and almost a third of the females in the labor market being retirees, hence there are more men in the labor market.[3,5]

The falls were more frequent in women - results consistent with the literature.[22-25,29] In the present study, there was a significant association between gender and falling, in which men are 52% less likely to fall than women, therefore being male is a protective factor. This result was also presented by Reyes-Ortiz, Al Snih, and Markides,[24] in a study conducted from data of the projects SABE and H-EPESE, pointing out that, among the independent risk factors for one or more falls, the female sex was the only variable that was associated in all the cities of the study.

However, the mechanisms to elucidate this phenomenon are unclear and controversial. Some factors recognized as a cause include the amount of lean body mass and muscle strength being lower than men of the same age; greater bone mass loss due to the reduction of estrogen, increasing the likelihood of osteoporosis; a higher prevalence of chronic diseases; and more exposure to domestic activities, due to the many tasks that women perform.[24]

In relation to hospitalization, it is recognized as a risk factor in the functional decline of older people[31] and in this study there was a significant association between falling and hospitalization in the last 12 months. In agreement with the literature[30] the hospitalization

Table 2. Characterization of the participants, according to variables related to health conditions, Londrina, 2015

Variables	Overall/Total participant		Fallers		Non-fallers		p
	N	%	N	%	N	%	
GDS							
Yes	21	8.3	7	33.3	14	66.7	0.158
No	233	91.7	47	20.2	186	79.8	
Perception of Own Health							
Excellent	113	44.5	19	16.8	94	83.2	0.200
Good	133	52.4	32	24.1	101	75.9	
Bad	8	3.1	3	37.5	5	62.5	
Sleep							
Altered	151	59.4	34	22.5	117	77.5	0.553
No alterations	103	40.6	20	19.4	83	80.6	
BMI							
≤ 27 (Kg/m²)	113	44.5	20	17.7	93	82.3	0.214
> 27 (Kg/m²)	141	55.5	34	24.1	107	75.9	
Smoker							
Yes	31	12.2	5	16.1	26	83.9	0.456
No	223	87.8	49	22.0	174	78.0	
Medicines							
None	55	21.7	7	12.7	48	87.3	0.63
1 to 4	187	73.6	42	22.5	145	77.5	
5 or more	12	4.7	5	41.7	7	58.3	
Hospitalization in the last 12 months							
Yes	39	15.4	19	48.7	20	51.3	0.000*
No	215	84.6	35	16.3	180	83.7	
Living alone							
Yes	58	22.8	16	27.6	42	72.4	0.180
No	196	77.2	38	19.4	158	80.6	
Physical Activity							
Active	145	57.1	31	21.4	114	78.6	0.957
Sedentary	109	42.9	23	21.1	86	78.9	
Has fallen in the last 12 months							
Yes	54	21.3					
No	200	78.7					

GDS: Geriatric Depression Scale; BMI: Body Mass Index; *p*: test χ^2 Pearson; * $p < 0.05$

Table 3. Characterization of the participants, according to variables of functional performance, Londrina, 2015

Variables	Overall/Total participant		Fallers		Non-fallers		p
	N	%	N	%	N	%	
TUG							
Independent	129	50.8	23	17.8	106	82.2	0.175
Semi-independent	125	49.2	31	24.8	94	75.2	
HGS							
Suitable	211	83.1	45	21.3	166	78.7	0.954
Poor	43	16.9	9	20.9	34	79.1	
GS 4.6 meters							
Adequate (fast)	243	95.7	48	19.8	195	80.2	0.006*
Lower (Slow)	11	4.3	6	54.5	5	45.5	
SR Test							
< 13 seconds	231**	90.9	46	19.9	185	80.1	0.072
> 13 seconds	22**	8.7	8	36.4	14	63.6	
Static Balance							
No difficulty	223***	87.8	45	20.2	178	79.8	0.257
With difficulty	27***	10.6	8	29.6	19	70.4	

TUG Timed Up and Go Test; HGS: Handgrip Strength; GS: Gait Speed; SR: Sitting and Rising; *p:* test χ^2 Pearson; * $p < 0.05$; **loss in SR test (01); *** loss in Balance test (04)

period leads to a change in the functional performance of older adults. This functional loss can still be aggravated at discharge, and may continue for months, leading to a reduction of independence with negative effects on the quality of life of the elderly.[31]

The present study showed no differences in relation to the occupational aspects and falling. In relation to the demands of the job, 63.4% carry out predominantly mental activities, in agreement with the literature. Although it is the elderly with lower levels of education and with worse socioeconomic conditions that most participate in the labor market, as they get older those with the best chances of remaining active are the best qualified, with more schooling and, especially, to those who are not involved in manual activities.[3.5]

In the present study, the GDS had no significant association with falls and, according to Silva Sá et al.,[32] working brings benefits to the lives of the elderly, being a way to keep the elderly physically or mentally active, but it can also be a good means of improving the quality of life with advancing age.[33] For the World Health Organization, the practice of physical activity can retard functional declines, favoring an active life with improved mental health and thereby helping in the management of disorders such as depression and dementia. There is evidence that the physically active elderly have a lower prevalence of mental illness than the inactive.[34]

According to Guimarães et al.,[28] physical activity is a therapeutic modality that improves one's physical mobility and postural stability, which are directly related to reducing falls. The measures of muscle strength, balance, and mobility in the present study demonstrated good functional condition, corroborating as well with the findings.[29] Working can be considered a favorable factor for these results, since there is a positive relationship between working and aging which shows that older workers tend to have better health conditions than the elderly population in general.[33]

The GS showed significant association with falling, with those that presented an adequate gait (fast) having an 80% chance of not suffering falls. Similar findings were found in a cohort study,[35] where the authors assessed the GS from a group of elderly people, differentiating them at three levels of speed (high, medium, and low). The authors found that the group with slowest gait had more falls, among other adverse events.

The GS is the parameter that best represents the performance of the gait, although some changes in the gait pattern in the elderly are not fully understood.[36] Some

Table 4. The Final of Poisson Regression Model for the association between falling and the independent variables of the study, Londrina, 2015

Variables	Adjusted PR	CI 95%	*p*
Male	0.625	(0.397 - 0.985)	0.043
Hospitalization in the last 12 months (yes)	2.792	(1.804 - 4.323)	0.000
GS (adequate)	0.462	(0.264 - 0.809)	0.007

PR: Prevalence Ratio; GS: Gait speed

authors interpret the phenomenon of slower gait as a compensatory strategy to ensure stability, however there is no consensus on the issue. According to Graf et al.,[37] the impairment of gait in the elderly is related to decreased physical function and increased risk of falling. The GS can be used as a simple and accessible indicator of health in the elderly, but could also help redefine estimates of survivals in clinical practice or in research.[38]

Some limitations of the study can be identified in order to provide greater clarity and security in interpreting the results. The answer to the dependent variable for falls was obtained through self-report, based on strategies of remembering, which can lead to memory bias. It is noteworthy that the complexity of the process of determining the occurrence of falls and the limitation of cross-sectional studies preclude the identification of temporal precedence of the factors studied, compromising the evidence of causal relationship.

It is suggested that other studies be carried out focusing on this theme, with the aim of estimating factors associated with risk or protection in this population of elderly workers. At the moment, these studies are rare and it is believed that this research can reveal the influence that working has on the quality of life of the elderly and thereby contribute to formulating new strategies aimed at this new class of workers, thus subsidizing the planning of care actions specific to this population.

CONCLUSION

The study shows that the prevalence of falls among elderly workers is lower than in the elderly population general and demonstrated a positive relationship between working and aging. It was found that being male is a protective factor for falling and that a history of hospitalization within the last 12 months and alterations in gait speed are risk factors.

The results found can contribute to the development of new prevention strategies and assist in directing public health policies aimed at the elderly worker's health and in interventions of health professionals.

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