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Understanding fall risk factors in community-dwelling older adults: A cross-sectional study

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Abstract

Aim and objective: Ageing is associated with an increased risk of falling. Identification of risk factors is crucial for the prevention of falls in older people.

Methods: A total of 508 older adults enrolled in a cross-sectional study. For the assessment of risk factors, the research team collected basic data and health-related information and performed morphofunctional evaluations (strength and flexibility of lower body and dynamic balance).

Results: A significantly greater proportion of women experienced fall episodes within the past year. Additionally, certain chronic diseases were significantly more prevalent in the fall subgroup compared to the non-fall subgroup. The non-fall subgroup showed significantly better scores of lower body strength and dynamic balance than the fall subgroup.

Conclusion: Multivariable regression analysis revealed that gender and lower body strength seem to be the main risk factors for fall event (s) within the past year in community-dwelling older adults from the Portuguese region of Alentejo.

Implications for practice: Differences in fall risk factors due to gender, ethnicity and geography must be taken into account in clinical practice. Nurses must identify the environmental, social and individual risks that constitute health threats and trigger protective intervention programs. Nursing care for older people must also meet needs related to physical activity (e.g., strength-training exercise), since lower body weakness is strongly associated with falls.

KEYWORDS

dynamic balance, falls, lower body strength, seniors

1 | INTRODUCTION

Physiological decline inherently accompanies the ageing process, affecting, among other factors, physical fitness. Consequently, falls are one of the major causes of injuries and mortality in older adults, affecting their quality of life and independence (Ahmadiahangar et al., 2018; Esain, Rodriguez-Larrad, Bidaurrazaga-Letona, & Gil, 2017). Frequently, falls are a consequence of the concurrence of several risk factors that can be classified as intrinsic and extrinsic factors (Pfortmueller, Lindner, & Exadaktylos, 2014). Among these factors, sarcopenia, comorbidity and polypharmacy seem to increase fall risk incidence to a great extent (Ahmadiahangar et al., 2018; Esain et al., 2017; Gafner et al., 2017; Pfortmueller et al., 2014). Unfortunately, some of the consequences for older adults are physical harm, loss

of self-confidence and lack of autonomy to perform daily tasks that ultimately lead to depression and social isolation (Ahmadiahangar et al., 2018; Worapanwisit, Prabpai, & Rosenberg, 2018). In this sense, it has been demonstrated that multifactorial interventions are more effective in the prevention of falls and fall-related injuries (Goodwin et al., 2014).

Population ageing presents major challenges for our society. The World Health Organization (WHO) predicts that between 2000 and 2050, the percentage of people over the age of 60 will increase from 11% to 22% (WHO, 2007). In the European Union, this phenomenon is more pronounced in some countries than in others, such as Portugal; thus, by 2060, the Portuguese population aged over 65 years is expected to be 29% of the total population (UNECE, 2017). In addition to the reversal of the demographic pyramid, our society has to face the socio-economic challenge of supporting the health management of an increasingly ageing population with comorbidities, which is costly for individuals, families and healthcare systems. Falls and the risk of falls themselves are indicators of the quality of health care and also a quality criterion of the professional practice of public and community health nursing. This nursing phenomenon has special relevance in clinical practice and requires the continuous attention of nurses as a sensitive area for nursing care, as pointed out by Morse (2009), for whom, prevention work should focus on identifying risk factors and implementing protective measures by nurses. Therefore, ageing demands a comprehensive public health response based on different and innovative approaches to reach the goal of active ageing (WHO, 2002).

In recent years, the studies about the influence of the different risk factors of falls in older adults have reached inconsistent results; it is noteworthy that racial and geographical differences might have an influence on risk factors, as well as on the frequency of falls (Nicklett & Taylor, 2014). Given the little scientific research about the major risk factors for falls in community-dwelling older people in Portugal, the aims of this study were as follows: (a) to draw a profile based on sociodemographic, health status and morphofunctional variables of older adults with a history of falls in the past year and (b) to evaluate the involvement of these variables as risk factors in fall episodes.

What does this research add to existing knowledge in gerontology

- This research provides an exhaustive description of interprofessional team members' experiences caring for older people.
- This research points out the need to promote the improvement of physical performance in older people to prevent falls.
- This research reinforces evidence related to two of the more problematic aspects of health management in older people, comorbidity and polypharmacy.

What are the implications of this new knowledge for nursing care with older people

- Differences in fall risk factors due to gender, ethnicity and geography must be taken into account in clinical practice.
- Nursing care for older people must also meet needs related to physical activity (e.g., strength-training exercise), since lower body weakness is strongly associated with falls.

How could the findings be used to influence policy or practice or research or education

- The understanding of fall risk factors of the population of each country helps to design and implement specific programmes focused on the prevention of this global health problem.
- As part of the effort to promote active ageing, the improvement of physical performance must be a policy priority for facing the challenge of population ageing.

2 | MATERIALS AND METHODS

2.1 | Participants

Participants were community-dwelling men and women aged ≥ 65 years old from the district of Évora (Portugal) mainly recruited from community settings. Local senior university, parishes, city hall and health promotion fairs helped in the recruitment, ensuring in this way the variability in the sample; the researchers also encourage caregivers (mainly family members) of more vulnerable senior adults to collaborate by answering some questions related to their falls. Authors calculated the minimum representative sample size of the total population of older people ≥ 65 years old (n = 182,988) based on the formula recommended for sample estimation in cross-sectional studies of finite populations used by the software for epidemiologic statistics OpenEpi (Dean, Sullivan, & Soe, 2014). The parameters under consideration were as follows: 95% significance level (Z_a = 1.96); 5% sampling error; size of the population: 182,988 older persons registered in the system; and hypothesised % frequency of outcome factor in the population (p) (50%). Based on these parameters, the minimum sample size to be representative of the total population was 384 older adults.

The inclusion criteria were age ≥65 years old, living at home and the absence of severe cognitive impairment. Research team assessed cognitive status using the Portuguese norms of the clock-drawing test (Santana, Duro, Freitas, Alves, & Simoes, 2013). The University of Évora Ethics Committee for research in the areas of human health and well-being (reference number 16-012) approved this study, which followed the updates of the Declaration of

Helsinki, amended by the 64th World Medical Association General Assembly (WMA, 2013). All older adults gave full informed written consent for participation. The researchers performed the data collection from April 2017 to January 2018 at the Superior Nursing School Laboratory in Évora, Portugal. A total of 508 older adults (113 males and 395 females) enrolled in the present study. The research team categorised participants according to the number of falls experienced within the past year: the non-fall subgroup (those who had never experienced any fall) and the fall subgroup (those who had one or more falls).

2.2 | Measures, design and procedures

2.2.1 | Basic data and health-related information

The researchers conducted face-to-face interviews to collect sociodemographic characteristics (gender, age, retirement age, civil and living status, and education and income levels) and health-related information, including body weight and height (for BMI calculation), current medications (types of drugs), self-reported medical histories (chronic diseases) and episodes of falls within the past year.

2.2.2 | Morphofunctional evaluation

The research team explained all procedures in detail and also encouraged participants to perform the following tests to the best of their abilities:

2.3 | Lower body strength

To assess muscle resistance and strength in the lower limbs, the authors performed a 30-s chair-stand test. The participants had to sit on a stable chair (approximately 43 cm tall) with back straight, crossed arms held against the chest and feet shoulder-width apart; at signal "go", participants sat and stood up repeatedly from the chair for 30 s., under the supervision of the researchers. The total score corresponded to the number of stands executed correctly in the above-mentioned period of time (Rikli & Jones, 1999). A prior study (Gill & McBurney, 2008) showed that this test has an interrater reliability of r = .95 and an intraclass correlation coefficient (ICC = 0.99) over 0.98.

2.4 | Lower body flexibility

To assess this variable, the participants sitting on a chair with one leg extended and foot at 90° to the floor had to flex the trunk and try to reach their toes. The researcher recorded the distance (cm) (+ or −) between extended fingers and the tip of the toe, which represents the zero point. The final score corresponded to the best score of two repetitions (Rikli & Jones, 1999). As pointed by Jones, Rikli, Max, and Noffal (1998), this test has a good intraclass test–retest reliability (R = .92 for men; R = .96 for women) and a moderate-to-good relationship with the criterion measure (r = .76 for men; r = .81 for women).

2.5 | Dynamic balance

To assess the dynamic balance, participants performed twice a timed up-and-go test under the instruction and supervision of the researchers. For this purpose, the participants sat on a stable chair (approximately 43 cm tall), stood up at signal "go", walked to a point located 2.44 m ahead and returned to sit on the chair in the shortest time possible. The final score corresponded to the best time (measured to the 1/100th of a second) between the signal "go" and the return to a seated position (Rikli & Jones, 1999). This test has an interrater reliability of r = .99 and an intraclass correlation coefficient (ICC = 0.99) over 0.99 (Greenberg, 2012).

2.6 | Statistical analysis

Values are expressed descriptively in terms of numbers of cases, mean ± standard deviation (*SD*) (continuous variables) and frequency (%) (categorical variables). To analyse significant differences between groups (non-fall/fall), unpaired t tests and chi-square tests are performed for continuous and categorical variables, respectively. Then, the multivariable logistic regression analysis has allowed research team to investigate the associations between fall history (dependent variable) and the independent variables that were significant ($p \leq .05$) in the univariate analyses, including gender, lower body strength, dynamic balance and chronic diseases (depression, osteoporosis, arthrosis, arthritis, poliomyelitis and fibromyalgia). For this purpose, researchers built the regression model using the Enter Method and the gender adjustment factor. In addition, since risk factors for falls must be easily and quickly interpreted, authors have dichotomised categorical variables (gender: male/female; chronic diseases: no/yes). The Hosmer–Lemeshow test helped to assess the goodness of fit of the model. The results are presented as adjusted odds ratios (AORs) with 95% confidence intervals (CIs). Statistical analyses are carried out using the Statistical Package for Social Sciences (SPSS v.25; IBM) for Windows. Statistical significance was established at $p < .05$.

3 | RESULTS

General characteristics of the study population are shown descriptively in Table 1. A total of 508 older adults (women, 77.8%) are analysed. The mean age was 73.4 ± 6.5 years, and the mean retirement age was 60.3 ± 6.1 years. Most participants were married (62.2%) and lived with their spouses (52.5%). A total of 94% of the study

TABLE 1 General characteristics of the study population (*N* = 508) with and without falls

Characteristics	Category	Total (*N* = 508)	No falls (*n* = 290)	Falls (*n* = 218)	*p* Value
Age, years[a]	–	73.4 ± 6.5	73.2 ± 6.1	73.7 ± 6.9	.345
Retirement age, years[a]	–	60.3 ± 6.1	60.5 ± 6.0	60.2 ± 6.2	.622
Gender[b]	Female	77.8 (395)	73.1 (212)	83.9 (183)	.040
	Male	22.2 (113)	26.9 (78)	16.1 (35)	
Civil status[b]	Married	62.2 (316)	61.7 (179)	62.8 (137)	.690
	Unmarried	6.1 (31)	6.2 (18)	6.0 (13)	
	Widower	28.1 (143)	27.6 (80)	28.9 (63)	
	Separated/ divorced	3.1 (16)	4.1 (12)	1.8 (4)	
	Unmarried partner	0.4 (2)	0.3 (1)	0.5 (1)	
Living with[b]	Spouse	52.5 (267)	52.1 (151)	53.2 (116)	.798
	Alone	27.8 (141)	27.9 (81)	27.5 (60)	
	Family	9.3 (47)	9.0 (26)	9.6 (21)	
	Children	5.5 (28)	6.2 (18)	4.6 (10)	
	Partner	1.2 (6)	1.4 (4)	0.9 (2)	
	Grandchild	1.0 (5)	1.0 (3)	0.9 (2)	
	Siblings	1.4 (7)	0.7 (2)	2.3 (5)	
	Others	1.4 (7)	1.7 (5)	0.9 (2)	
Education level[b]	<High school	94.1 (478)	93.8 (272)	94.5 (206)	.740
	High school or higher	5.9 (30)	6.2 (18)	5.5 (12)	
Income level[b]	Do not know/ did not answer	1.0 (5)	1.4 (4)	0.5 (1)	.369
	<350€	33.9 (172)	31.4 (91)	37.2 (81)	
	350–1550€	60.6 (308)	62.1 (180)	58.7 (128)	
	>1,550€	4.6 (23)	5.2 (15)	3.7 (8)	

[a]Values expressed as the mean ± *SD*; *p* values of *t* test analysis.

[b]Values expressed as %(*n*); *p* values of chi-square analysis.

population had an educational level equal to or lower than compulsory education (≤12 years), and only 5.9% engaged in higher studies (≥14 years). The monthly income was in the range of 350–1,550€ for 60.6% of the older adults analysed. The results of a statistical comparison of the non-fall and fall subgroups are shown in Table 1. A significantly greater proportion of women experienced fall episodes within the past year (83.9% vs. 73.1%; $p < .04$). However, no significant differences in other sociodemographic variables are observed between the subgroups.

Variables related to health status and morphofunctional evaluation of the study population are descriptively expressed in Table 2. A total of 83.6% of participants had BMI values >25 (overweight or obese). Among the registered categories of drugs, anxiolytic (10.8%) or a mixture of the above-mentioned drugs (10.5%) is the most consumed by the Alentejo older adult population; however, most participants (72.4%) declared to be taking another kind of medicine not included in these categories. With regard to the incidence of chronic diseases, 42.6% of the older adults had 3 or more conditions, including diabetes (20.5%) and cardiovascular (hypertension: 66.5%), neurologic (depression: 17.0%), and osteoarticular (arthrosis: 26.4%) diseases. For variables related to morphofunctional evaluation, in this population, the lower body strength mean score was 12.65 ± 4.7 (nº of stands/30 s) and the dynamic balance mean score was 7.21 ± 2.53 (s). It was also noted that most of the older adults obtained a lower body flexibility score ranging from 0 to −10 cm (44.7%). In addition, descriptive analysis between subgroups revealed that comorbidity (three or more conditions) was higher in those who had fallen within the past year compared to those who had not; however, the observed difference did not reach statistical significance ($p = .067$). Moreover, certain chronic diseases were significantly more prevalent in the fall subgroup compared to the non-fall subgroup, such as depression (21.6% vs. 13.5%; $p = .017$), osteoporosis (15.6% vs. 9.0%;

TABLE 2 Health status and morphofunctional evaluation of the study population (N = 508) with and without falls

Variable	Category	Total (N = 508)	No falls (n = 290)	Falls (n = 218)	p Value
Lower body strength, n° of stands/30 (s)[a]		12.65 ± 4.7	13.22 ± 4.6	11.83 ± 4.7	.001
Dynamic balance (s)[a]		7.21 ± 2.53	6.91 ± 2.4	7.63 ± 2.6	.002
Lower body flexibility (cm)[b]	>−20	7.7 (38)	6.7 (19)	9.1 (19)	.653
	From −11 to −19	14.0 (69)	15.4 (44)	12.0 (25)	
	From 0 to −10	44.7 (221)	43.5 (124)	46.4 (97)	
	From 1 to 10	28.7 (142)	29.1 (83)	28.2 (59)	
	From 11 to 19	4.9 (24)	5.3 (15)	4.3 (9)	
BMI[b]	<25	16.4 (82)	17.8 (51)	14.6 (31)	.348
	>25	83.6 (417)	82.2 (236)	85.4 (181)	
Drugs[b]	Psychotropic	1.2 (6)	1.4 (4)	0.9 (2)	.345
	Anxiolytic	10.8 (55)	12.1 (35)	9.2 (20)	
	Anti-inflammatory	2.8 (14)	2.8 (8)	2.8 (6)	
	Diuretic	2.4 (12)	2.1 (6)	2.8 (6)	
	Mixture	10.5 (53)	8.0 (23)	13.8 (30)	
	Other drugs	72.4 (367)	73.7 (213)	70.6 (154)	
Comorbidity[b]	No chronic illness conditions	10.1 (51)	12.1 (35)	7.3 (16)	.067
	1 condition	21.3 (108)	23.5 (68)	18.3 (40)	
	2 conditions	26.0 (132)	26.0 (75)	26.1 (57)	
	3 or more conditions	42.6 (216)	38.4 (111)	48.2 (105)	
Chronic diseases[b]	Lung	6.9 (35)	6.9 (20)	6.9 (15)	.986
	Cardiovascular	31.4 (159)	28.7 (83)	34.9 (76)	.14
	Vascular	26.4 (134)	24.9 (72)	28.4 (62)	.373
	Hypertension	66.5 (337)	64.4 (186)	69.3 (151)	.247
	Neurologic				
	Parkinson's disease	1.4 (7)	1.4 (4)	1.4 (3)	.994
	Sclerosis	0.2 (1)	–	0.5 (1)	.249
	Depression	17.0 (86)	13.5 (39)	21.6 (47)	.017
	Neuropathy	1.4 (7)	1.0 (3)	1.8 (4)	.447
	Epilepsy	1.4 (7)	1.0 (3)	1.8 (4)	.447
	Others	1.8 (9)	2.1 (6)	1.4 (3)	.555
	Osteoarticular				
	Osteoporosis	11.8 (60)	9.0 (26)	15.6 (34)	.023
	Arthrosis	26.4 (134)	22.1 (64)	32.1 (70)	.012
	Arthritis	3.7 (19)	2.1 (6)	6.0 (13)	.023
	Others	10.3 (52)	9.3 (27)	11.5 (25)	.435
	Diabetes	20.5 (104)	17.6 (51)	24.3 (53)	.066
	Cancer	4.1 (21)	5.2 (15)	2.8 (6)	.173
	Poliomyelitis	4.1 (21)	2.4 (7)	6.4 (14)	.025
	Fibromyalgia	1.2 (6)	0.3 (1)	2.3 (5)	.045
	Ménière's syndrome	9.7 (49)	9.3 (27)	10.1 (22)	.777

[a]Values expressed as the mean ± standard deviation; p values of t test analysis.

[b]Values expressed as %(n); p values of chi-square analysis.

p = .023), arthrosis (32.1% vs. 22.1%; p = .012), arthritis (6.0% vs. 2.1%; p = .023), poliomyelitis (6.4% vs. 2.4%; p = .025) and fibromyalgia (2.3% vs. 0,3%; p = .045). Finally, the non-fall subgroup showed significantly better scores on lower body strength (13.22 ± 4.6 vs. 11.83 ± 4.7 number of stands/30 s; p = .001) and on dynamic balance (6.91 ± 2.4 vs. 7.63 ± 2.6 s; p = .002) than the fall subgroup.

TABLE 3 Associated factors of falls in the study population with the calculation of adjusted OR using multiple regression analysis

Variable	Category	No falls (*n* = 290)	Falls (*n* = 218)	Adjusted OR (95% CI)
Lower body strength, nº of stands/30 (s)		13.22 ± 4.6	11.83 ± 4.7	0.955 (0.910–1.002)
Dynamic balance (s)		6.91 ± 2.4	7.63 ± 2.6	1.067 (0.977–1.165)
Gender[a]	Female	73.1 (212)	83.9 (183)	1.724 (1.069–2.782)
	Male	26.9 (78)	16.1 (35)	
Chronic diseases[a]	Depression	13.5 (39)	21.6 (47)	0.763 (0.463–1.258)
	Osteoarticular			
	Osteoporosis	9.0 (26)	15.6 (34)	0.751 (0.414–1.363)
	Arthrosis	22.1 (64)	32.1 (70)	0.820 (0.527–1.278)
	Arthritis	2.1 (6)	6.0 (13)	0.466 (0.162–1.345)
	Poliomyelitis	0.3 (1)	6.4 (14)	0.636 (0.234–1.731)
	Fibromyalgia	9.3 (27)	2.3 (5)	0.215 (0.023–2.016)

[a]Values expressed as the mean ± *SD*.

[b]Values expressed as % (*n*).

Subsequently, factors associated with fall episode(s) within the past year among the studied Alentejo older adult population were analysed in depth. For this purpose, a multivariable logistic regression model was used (Table 3). The analysis showed that gender (AOR 1.724, 95% CI 1.069–2.782) was a significant predictor of fall events. Moreover, it was noted that the association between a greater lower body strength and reduced occurrence of fall(s) (AOR 0.955, 95% CI 0.910–1.002) was of borderline statistical significance. However, this analysis also revealed that when lower body strength was included in the modelling process, there was no association between falls and the other factors, including depression (AOR 0.763, 95% CI 0.463–1.258), osteoporosis (AOR 0.751, 95% CI 0.414–1.363), arthrosis (AOR 0.820, 95% CI 0.527–1.278), arthritis (AOR 0.466, 95% CI 0.162–1.345), poliomyelitis (AOR 0.636, 95% CI 0.234–1.731), fibromyalgia (AOR 0.215, 95% CI 0.023–2.016) and dynamic balance (AOR 1.067, 95% CI 0.977–1.165).

4 | DISCUSSION

Currently, falls are one of the major causes of injuries and mortality in increasingly older populations, leading to poor quality of life and high costs for healthcare services (WHO, 2002). For this reason, identification of the risk factors is a priority for governmental organisations worldwide, locally, nationally and internationally.

In the present study, the risk factors for falls in community-dwelling older adults are analysed, revealing that 42.9% of the studied population experienced one or more fall episode(s) within the past year. With regard to sociodemographic characteristics, female gender is identified as an influential risk factor for falls in this population, which is in agreement with previous studies carried out in the Portuguese older population (Moniz-Pereira, Carnide, Machado, Andre, & Veloso, 2012; Moniz-Pereira et al., 2013). A higher prevalence of falls is also reported in women in other regions of the world (Jeon, Gu, & Yim, 2017; Lavedán et al., 2018; Nicklett, Taylor, Rostant, Johnson, & Evans, 2017), which could be linked to an inherent bone fragility in postmenopausal women caused by osteoporosis, osteoarthritis, obesity and vitamin D deficiency (Ahmadiahangar et al., 2018; Rezende Cde, Gaede-Carrillo, & Sebastião, 2012). For this reason, some countries, such as the United States, recommend screening for osteoporosis in all women ≥65 years and in younger women at increased risk (USPSTF, 2011). In contrast to our results, other authors have also observed that advancing age, education level, residential location and civil and socio-economic status are significantly associated with falls in senior adults (Ambrose, Paul, & Hausdorff, 2013; Deandrea et al., 2010; Worapanwisit et al., 2018). According to previous studies performed in older adults living in a more urban area of Portugal (Moniz-Pereira et al., 2012, 2013), advancing age is also not found to be a significant risk factor for recurrent falls, unlike other sociodemographic characteristics such as living alone and education level (Dhalwani et al., 2017; Pfortmueller et al., 2014; Rezende Cde et al., 2012).

Additionally, our results related to health status showed that several chronic diseases were more prevalent in the fall subgroup compared with the non-fall subgroup; moreover, it should be mentioned that diabetes and/or comorbidity appeared as other potentially important risk factors but did not reach statistical significance ($p = .066$ and $p = .067$, respectively). Other researchers have found similar results, such as those obtained in prior studies carried out on older populations of distinct ethnicities (Jeon et al., 2017; Nicklett et al., 2017; Yang et al., 2018). As pointed out by Vinik et al. (2017), diabetes is one of the major risk factors for falling due to loss of strength, sensory perception and balance as a consequence of peripheral neuropathy and cognitive deficit. Until recently, chronic conditions have considered individually or as mediating factors of fall-related events (Pfortmueller et al., 2014). However, a growing number of studies have confirmed that comorbidity and therefore polypharmacy (≥5 drugs) are risk factors for falls in older adults

(Dhalwani et al., 2017; Pfortmueller et al., 2014; Rezende Cde et al., 2012). In this sense, Moniz-Pereira et al. (2013) reported a significantly lower percentage of medication consumption in Portuguese older adults who never experienced a fall event compared to the subgroup including those who experienced episodic and recurrent falls. Furthermore, other chronic diseases, including dementia (e.g., Alzheimer's disease) and visual impairments (e.g., cataract) (Yang et al., 2018), as well as the use of some drugs, mainly diuretics, sedatives, anticonvulsants and antidepressants (Dhalwani et al., 2017; Rezende Cde et al., 2012), appear in the literature as factors significantly associated with fall events in community-dwelling older adults. In fact, the above-mentioned drugs are considered "fall risk-increasing drugs," causing sedation and impaired balance and coordination (Pfortmueller et al., 2014).

With regard to morphofunctional evaluation, lower body strength and dynamic balance are observed as significant factors in the fall subgroup from a statistical point of view. In addition, a multivariable logistic regression model showed that, along with gender, the lower body strength seems to be the main independent factor influencing fall events. Interestingly, there are no significant differences related to the rest of variables when the model is constructed. This may be due to the possibility of a strong effect of the lower body strength variable in the model, which would render the other variables less relevant from a statistical point of view. The statistically significant relationship between muscle strength and falls is reported in systematic reviews (Moreland, Richardson, Goldsmith, & Clase, 2004) and many recent cross-sectional studies (Ahmadiahangar et al., 2018; Gafner et al., 2017; Jeon et al., 2017; Scott et al., 2014; Yang et al., 2018), including those carried out in Portugal (Moniz-Pereira et al., 2012, 2013). As defined by Gray, Glenn, and Binns (2016), sarcopenia is an age-related lean tissue mass loss that leads to reduced physical function, muscular strength and mobility. From a physiological point of view, elderly skeletal muscle performance is driven by several systems, including nervous, muscular and skeletal systems, which in turn are influenced by biology (e.g., genetics, comorbidity and chronic inflammation), lifestyle (e.g., smoking habit, malnutrition and sedentary behaviour) and psychosocial factors (e.g., fear of falling and loneliness) (Pfortmueller et al., 2014; Sampaio et al., 2017; Tieland, Trouwborst, & Clark, 2018). According to the results obtained in the present study, it is likely that the higher incidence of debilitating diseases in the fall subgroup is associated with sarcopenia, causing the significant lower limb weakness observed in comparison with the non-fall subgroup. The resulting poor walking ability, together with the presence of other factors affecting stability and gait, including comorbidity and polypharmacy, seems to generate an adverse physiological context that leads to an increased risk of falls in the studied population. For this reason, exercise interventions consisting in supervised individual/group classes and physical therapy are demonstrated to be effective in reducing falls and subsequent disability in older adults (Ahmadiangar et al., 2018; Grossman et al., 2018). Thus, it is recommended that older adults perform at least 150 min per week of moderate-intensity or 75 min per week of vigorous-intensity aerobic physical activity as well as muscle-strengthening activities twice per week (US Department of Health & Human Services, 2008, 2008). In addition, resistance training is also proposed as an important strategy to improve muscle mass, muscle strength, power output and functional capacity (López et al., 2018). However, statistics suggest that older people are far from meeting the current recommendations of PA for health maintenance, due to a variety of intrinsic determinants of individuals and nations, including age, gender, culture, socio-economic characteristics, behaviour and environment (O'Donoghue et al., 2016). Even those older adults using physical activity programmes perceive different barriers, mainly physical limitations, lack of professional guidance and difficulties in accessing information on available and appropriate PA options and programmes (Bethancourt, Rosenberg, Beatty, & Arterburn, 2014).

To the best of our knowledge, this is one of the few studies analysing the profile and risk factors for falls in Portuguese community-dwelling older adults. While it is true that many similar studies have addressed risk factors of falls in other parts of the world, there is a need to study the intrinsic characteristics of older population in each country and even each region. Mediterranean basin comprises diverse populations of several countries such as Portugal, sharing a cultural heritage which includes lifestyles and cultural habits. In this line, it should be also mentioned that Alentejo is one of the European regions considered as a priority by European Union; it is characterised by a low industrial development and a very aged population (CCDR Alentejo, 2018). Altogether, these intrinsic characteristics are ultimately going to determine ageing, for example in terms of prevalence of chronic diseases and physical fitness; consequently, the risk factors for falling are different from those identified in other populations of the world.

The potential limitations of the present study should be taken into account. The study design and the sample size might have influenced the detection of significant associations of several risk factors with fall events. However, cross-sectional design allows making an initial approach to the profile of risks before performing longitudinal studies in countries/regions that have not been previously analysed. The risk of sample bias must also be considered due to the overrepresentation of female participants in the studied population. In addition, the method of data collection with respect to some sociodemographic and health status characteristics (e.g., the incidence of falls, the use of medication and diagnosed chronic diseases) is based on self-reported data and retrospective recall; thus, some of these variables may be underestimated, and recall bias must be considered. However, face-to-face interviews are conducted by researchers, and morphofunctional evaluation is performed using well-established scientific tests. Furthermore, data analysis is performed by a blinded outcome assessor to reduce the possibility of bias. In any case, as mentioned before, racial and geographical differences could influence the involvement of certain fall risk factors and the frequency of falls, leading to the inconsistent results observed across studies. To cite one simple example, according to our results, the sample of older adults studied is characterised by low psychotropic and anxiolytic drug consumption; however, this is quite different from the

misuse of this kind of medication in other countries, for example in neighbouring Spain (Tellez-Lapeira et al., 2016).

5 | CONCLUSIONS

A significant proportion of community-dwelling older adults from the Alentejo region experienced one or more falls within the past year. The analysis of risk factors revealed that gender and lower body strength seem to be the main independent factors influencing fall events. The significant lower limb weakness observed in the fall subgroup might be influenced by the concurrent presence of debilitating diseases. Increasing evidence highlighted the fact that, with regard to the risk of falling, there are many different gender, ethnic and geographic profiles of older adults that are of great importance for their implications in nursing care (e.g., incidence of chronic diseases, misused medication and access to healthcare facilities). Since exercise interventions (individual or group classes) focused on improving physical fitness are highly recommended to reduce falls and subsequent disability in this population, nursing care of older adults, particularly women, must also comprise physical activity through the prescription of individually tailored exercise; among others, aerobic, strengthening and balance training as well as movement-based relaxation techniques (yoga and tai-chi) have demonstrated efficacy in improving muscle function, balance, bone mass and general quality of life of older adults. It should be taken into account that these exercise programmes must be both specific and long enough to have a positive impact on health. On balance, community stakeholders linked to health and social sectors have to play an essential role in the design and implementation of strong programmes that engage older adults to take part in their active ageing. Particularly, nurses must intervene and actively collaborate in identifying the environmental, social and individual risks that constitute health threats and trigger protective intervention programmes that enable the removal of potential hazards. WHO (2002) highlights this as one of the nurse's areas of intervention, recognising its crucial role in people's safety, whether in the community or in health institutions, always with the objective of promoting healthy and active ageing.

Implications for practice

- Differences in fall risk factors due to gender, ethnicity and geography must be taken into account in clinical practice.
- Nurses must identify the environmental, social and individual risks that constitute health threats and trigger protective intervention programs.
- Nursing care for older people must also meet needs related to physical activity (e.g., strength-training exercise), since lower body weakness is strongly associated with falls.

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CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest.

AUTHORS' CONTRIBUTIONS

Article draft and data analysis: CC; Study design, data collection and article draft: T-CP; Study design and data collection: BJ; Conception and study design, and data collection: PC; and Conception and study design: MF. All authors read and approved the final manuscript.

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