

Fall risk and the frailty syndrome in older adults

Risco de quedas e a síndrome da fragilidade no idoso
Riesgo de caídas y el síndrome de fragilidad en adultos mayoresAdriana Luna Pinto Dias^{1,2}  <https://orcid.org/0000-0001-8294-3165>Fabrícia Alves Pereira¹  <https://orcid.org/0000-0002-5844-0549>Cláudia Paloma de Lima Barbosa³  <https://orcid.org/0000-0002-0912-8313>Gleicy Karine Nascimento de Araújo-Monteiro⁴  <https://orcid.org/0000-0002-4395-6518>Renata Clemente dos Santos-Rodrigues³  <https://orcid.org/0000-0003-2916-6832>Rafaela Queiroga Souto¹  <https://orcid.org/0000-0002-7368-8497>

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Abstract

Objective: To analyze fall risk and its relationship with the frailty syndrome and sociodemographic variables in older adults.

Methods: This is a cross-sectional, analytical and multicenter study, carried out in two university hospitals, from August 2019 to January 2020, with 323 older adults, using the Brazil Old Age Schedule (BOAS), for sociodemographic characterization, the Morse Fall Scale (MFS), to define fall risk, and the Edmonton Frail Scale (EFS), to identify the frailty syndrome. Data were analyzed using descriptive and inferential statistics.

Results: There was an association between fall risk and older adults aged over 70 years, with more than four preexisting diseases, without work activity, with cognitive impairment, poor general health status, with functional dependence in five to eight activities, using five or more medications, with weight loss, low functional performance, sad or depressed mood and with the installed frailty syndrome. Older adults who live alone, aged over 70 years, who have four or more previous illnesses, with functional dependence, depressed mood, who perform the Timed Up and Go (TUG) test in a time longer than 20 seconds, who use five or more medications per day and who forget to use these medications are more likely to fall at risk.

Conclusion: Factors related to the decline of physical, psychological and mental functions in older adults, which are exacerbated in the frailty syndrome, increase fall risk in this population.

Resumo

Objetivo: Analisar o risco de quedas e sua relação com a síndrome da fragilidade e variáveis sociodemográficas em idosos.

Métodos: Estudo transversal, analítico e multicêntrico, desenvolvido em dois hospitais universitários, no período de agosto de 2019 a janeiro de 2020, com 323 idosos, utilizando o *Brazil Old Age Schedule* (BOAS) para caracterização sociodemográfica, a *Morse Fall Scale* (MFS) para definição do risco de quedas e a *Edmonton Frail Scale* (EFS) para identificação da síndrome da fragilidade. Os dados foram analisados por estatística descritiva e inferencial.

Resultados: Houve associação entre o risco de quedas e idosos com idade acima de 70 anos, com mais de quatro doenças preexistentes, sem atividade laboral, com déficit cognitivo, estado geral de saúde ruim, com dependência funcional em cinco a oito atividades, fazendo uso de cinco ou mais medicamentos, com perda de peso, baixo desempenho funcional, humor triste ou deprimido e com a síndrome da fragilidade instalada. Idosos que moram sozinhos, com idade acima de 70 anos, que têm quatro ou mais doenças prévias, com

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dependência funcional, humor deprimido, que realizam o teste *Timed Up and Go* (TUG) em um tempo maior que 20 segundos, que utilizam cinco ou mais medicamentos por dia e que esquecem de utilizar esses fármacos têm mais chances para o risco de quedas.

Conclusão: Fatores relacionados ao declínio de funções físicas, psicológicas e mentais nos idosos, e que se encontram exacerbados na síndrome da fragilidade, aumentam o risco para a ocorrência de quedas nessa população.

Resumen

Objetivo: Analizar el riesgo de caídas y su relación con el síndrome de fragilidad y variables sociodemográficas en adultos mayores.

Métodos: Estudio transversal, analítico y multicéntrico, llevado a cabo en dos hospitales universitarios, durante el período de agosto de 2019 a enero de 2020, con 323 adultos mayores, utilizando el *Brazil Old Age Schedule* (BOAS) para la caracterización sociodemográfica, la *Morse Fall Scale* (MFS) para la definición del riesgo de caídas y la *Edmonton Frail Scale* (EFS) para la identificación del síndrome de fragilidad. Los datos fueron analizados por medio de estadística descriptiva e inferencial.

Resultados: Hubo una relación entre el riesgo de caídas y adultos mayores con edad superior a los 70 años, con más de cuatro enfermedades preexistentes, sin actividad laboral, con déficit cognitivo, estado general de salud malo, con dependencia funcional de cinco a ocho actividades, tomando cinco o más medicamentos, con pérdida de peso, bajo desempeño funcional, humor triste o deprimido y con síndrome de fragilidad instalado. Adultos mayores que viven solos, con edad superior a los 70 años, con cuatro o más enfermedades previas, con dependencia funcional, humor deprimido, que realizan la prueba *Timed Up and Go* (TUG) en un tiempo superior a 20 segundos, que utilizan cinco o más medicamentos al día y que se olvidan de utilizar esos fármacos tienen más posibilidades de riesgo de caídas.

Conclusión: Factores relacionados con el deterioro de funciones físicas, psicológicas y mentales en adultos mayores y que están exacerbados en el síndrome de fragilidad, aumentan el riesgo de episodios de caídas en esa población.

Introduction

Aging causes physiological changes, as well as functional changes, providing homeostatic imbalance and favoring the installation of dysfunctions.⁽¹⁾ The deterioration of several physical, sensory, perceptual, cognitive and muscular functions are correlated with fall risk in older adults.⁽²⁾

Falls in older adults are a serious public health concern, as they can result in injuries (such as bruises, cuts or abrasions), fractures, reduced functional capacity, hospitalizations, psychological damage (such as fear of suffering new falls), and may culminate in deaths.^(3,4)

In Brazil, the prevalence of falls in older adults living in the community reached estimates ranging from 6.5 to 46.9% from 2002 to 2019.⁽⁵⁾ In Asian countries, such as Korea, the rates of annual falls affecting older community-dwelling adults ranged from 15.9 to 25.1% between 2011 and 2017.⁽⁶⁾

Among the factors frequently associated with these events, advanced age, polypharmacy, age-related changes (memory loss, incontinence, pain and chronic illness, visual and gait impairments) and environmental conditions (such as poor lighting and uneven floors).⁽⁷⁾ Such aspects, when associated with the frailty syndrome, result in an increase in the number of falls, since these two situations have components in common.⁽⁸⁾

The frailty syndrome is characterized by a physiological state of greater vulnerability to stressors that results in a decrease in physiological reserves and dysregulation of multiple systems.⁽⁹⁾ Frail older adults are more likely to have multiple chronic illnesses, insomnia, poor oral health, balance/gait disorders and falls. In addition, they tend to use drugs that increase the fall risk and to be dependent on activities of daily living.⁽¹⁰⁾

The general prevalence of frailty in older Brazilian adults ranges from 6.7 to 74.1%, while in the United States this percentage drops to 14.3%.^(10,11) Factors associated with the risk of frailty in older adults include older age, being female, cognitive impairment, sedentary lifestyle and malnutrition, demonstrating that health conditions are important factors in determining this situation.⁽¹²⁾

Thus, the reciprocity between the frailty syndrome and the occurrence of falls is a major challenge in the context of aging, as the connectivity between these two episodes generates a cycle in which frailty plays a significant role in the etiology of falls, and these constitute a predictor for the onset of frailty.⁽⁸⁾

In this sense, it is understood that the frailty syndrome and fall risk go hand in hand in the context of aging, having a considerable impact on older adults' quality of life. Therefore, it is necessary to carry out studies that identify the factors that are

associated with the overlapping of these diseases, as well as subsidize the proposition of interventions that provide better living and health conditions in this population, especially those most affected.

Given the above, it is assumed that fall risk is associated with the frailty syndrome, as well as with sociodemographic variables in older adults. Therefore, this study aims to analyze fall risk and its relationship with the frailty syndrome and sociodemographic variables in older adults.

Methods

This is a cross-sectional, analytical and multicenter study, guided by the STROBE initiative, developed with older adults in two university hospitals in the state of Paraíba. The study population was based on the number of visits to people aged 60 years or older, in the year prior to data collection (n=1,259). Sampling (n=323) was carried out at random, being calculated based on the finite population formula for epidemiological studies, with an estimated prevalence of 60% and increased by 10% to ensure losses. Data collection took place between August 2019 and January 2020. Older adults aged 60 years or older, monitored at the outpatient service or hospitalized in the wards of the aforementioned hospitals, were included. Those with hemodynamic instability, who could not walk and with severe cognitive, communication and/or visual deficits were excluded, and these conditions were observed by the researcher or informed by the health team at the time of collection.

The instruments used included: the Brazil Old Age Schedule (BOAS), for outlining the sociodemographic profile; the Morse Fall Scale (MFS), to define the fall risk; and the Edmonton Frail Scale (EFS), to identify the frailty syndrome. The BOAS includes psychological, physical, socioeconomic and demographic aspects of older adults.⁽¹³⁾ This study used questions related to sex, age, marital status, years of study, living arrangement, preexisting diseases, work activity and income.

The MFS assesses fall risk through six items: history of falls; secondary diagnosis; walking aid;

intravenous therapy; march; and mental status. In this study, older adults who scored 24 points or less were classified as not at risk for falls, and those who scored more than 25 points on the scale were considered at risk for falls.⁽¹⁴⁾

The EFS investigates frailty based on nine domains, represented by 11 items: cognition (clock drawing test); general health status, including self-rated health and number of hospitalizations in the last year; functional independence; social support; medication use, including the use of five or more medications and forgetting to use them; nutrition (recent weight loss); depressed mood; urinary continence; and functional performance, assessed by the Timed Up and Go test (TUG).^(15,16)

The collected data were entered and analyzed in SPSS, version 21.0, with the risk for falls being determined as a dependent variable of the study. The frailty syndrome was dichotomized (with and without frailty), considering up to 6 points as non-frail and from 7 to 17 points representing frail older adults.⁽¹⁵⁾ The instrument domains also received analytical treatment. Data were analyzed using descriptive statistics (absolute and relative frequency, measures of central tendency and dispersion) and inferential statistics (Pearson's chi-square, linear regression and Spearman's correlation). The logistic regression model with the backward method was carried out between the variables that presented 20% of association in the bivariate analysis, establishing a significance level of 5% (p-value<0.05) for all variables.

This study deals with partial data from a universal project entitled "*Instrumentalização da Enfermagem Forense diante do cuidado ao idoso hospitalizado*". The development of the study complied with ethical standards under opinion 3.709.600/CAAE (*Certificado de Apresentação para Apreciação Ética* - Certificate of Presentation for Ethical Consideration) 10179719.9.0000.5183.

Results

The sample consisted of 323 older adults with a mean age of 70.8 years (SD=7.66), 5.9 years of

education (SD=5.4) and a mean of 1.5 preexisting diseases (SD=1.2). In the bivariate analysis, it is possible to observe significance between the fall risk aged over 70 years ($p<0.00$), with more than four preexisting diseases ($p=0.02$) and without work activity ($p=0.01$), as presented in Table 1.

Table 1. Association of fall risk and sociodemographic variables of older adult participants

Sociodemographic variables	Fall risk		p-value*
	With n(%)	Without n(%)	
Sex			
Male	64(50.4)	63(49.6)	0.12
Female	113(57.7)	83(42.3)	
Age			
60 to 70 years	79(46.5)	91(53.5)	0.00
Above 70 years	98(64.1)	55(35.9)	
Marital status			
No partner	90(58.1)	65(41.9)	0.16
With partner	87(52.1)	80(47.9)	
Years of study			
≥ 3 years	71(60.70)	46(39.3)	0.06
< 3 years	105(51.5)	99(48.5)	
Housing arrangement			
Living alone	12(34.3)	23(65.7)	0.08
Living with someone	165(57.3)	123(42.7)	
Preexisting diseases			
0 to 3 diseases	160(53.3)	140(46.7)	0.02**
≥ 4 diseases	17(77.3)	5(22.7)	
Work activity			
Yes	30(42.9)	40(57.1)	0.01
No	147(58.1)	106(41.9)	
Income			
Up to 1 MW	102(54.5)	85(45.5)	0.50
Above 1 MW	75(55.1)	61(44.9)	

* Pearson's chi-square test; ** Fisher's exact test; MW – minimum wage

The variables age, living arrangement and pre-existing diseases remain in the logistic regression model, inferring that older adults who live alone, aged over 70 years, with four or more pre-existing diseases present, respectively, 2.82 (CI=1.29-6.13; $p<0.00$), 1.99 (CI=1.12-6.13; $p<0.00$) and 3.22 (CI=1.10 - 9.42; $p=0.03$) more possibility of risk for falls. Fall risk is associated with the EFS domains: cognition ($p=0.06$), general health status ($p<0.00$), functional independence ($p<0.00$), medication use ($p<0.00$), nutrition ($p=0.04$), functional performance ($p<0.00$), depressed mood ($p<0.00$) and the categorical assessment of frailty ($p<0.00$) (Table 2).

In the logistic regression model between fall risk and the EFS domains, it is observed that older

Table 2. Association of fall risk and the EFS domains of older adult participants

ESF domains	Fall risk		p-value*
	Without n(%)	With n(%)	
Domain – Cognition			
CDT			
Approved	28(57.1)	21(42.9)	0.06
Failed with minimal errors	32(50.8)	31(49.2)	
Failed with significant errors	86(40.8)	125(59.2)	
Domain – GHS			
Number of admissions			
None	104(51.7)	97(48.3)	0.00
One to two	36(42.9)	48(57.1)	
> 2 times	6(15.8)	32(84.2)	
Self-rated health			
Excellent/good/very good	43(55.1)	35(44.9)	0.00
Reasonable	83(50.9)	80(49.1)	
Poor	20(24.7)	61(75.3)	
Domain – Functional independence			
Number of activities that need help			
0 - 1 activities	85(68.0)	40(32.0)	0.00
2 - 4 activities	42(40.0)	63(60.0)	
5 - 8 activities	19(20.4)	74(79.6)	
Domain – Social support			
Do you have someone to count on when you need help?			
Always	126(46.5)	145(53.5)	0.55**
Sometimes	17(39.5)	26(60.5)	
Never	3(33.3)	6(66.7)	
Domain – Medication use			
Do you use of five or more medications?			
Yes	110(53.9)	94(46.1)	0.00
No	36(30.3)	83(69.7)	
Do you sometimes forget to take your medication?			
No	94(58.0)	68(42.0)	0.00
Yes	52(32.3)	109(67.7)	
Domain – Nutrition			
Weight loss			
No	75(51.7)	70(48.3)	0.04
Yes	71(39.9)	107(60.1)	
Domain – Mood			
Feel sad or depressed			
No	100(55.6)	80(44.4)	0.00
Yes	46(32.2)	97(67.8)	
Domain – Continance			
Lose urine			
Yes	60(41.7)	84(58.3)	0.15
No	86(48.0)	93(52.0)	
Domain – Functional performance (TUG)			
0 to 10 seconds	59(55.7)	47(44.3)	0.00
11 to 20 seconds	57(55.9)	45(44.1)	
More than 20 seconds	30(26.1)	85(73.9)	
Frailty syndrome			
Without frailty	39(31.0)	87(69.0)	0.00
With frailty	138(70.1)	59(29.9)	

CDT – clock drawing test; GHS – general health status; TUG – Timed Up and Go test

adults with functional dependence in five to eight activities are 4.52 ($p<0.00$) more likely to be at risk of falling. Older adults who use five or more med-

ications a day and who forget to use the medications present, respectively, 2.23 ($p < 0.00$) and 1.92 ($p = 0.00$) more chances of falling risk. While older adults who feel sad or depressed and who take more than 20 seconds for the TUG test are 1.79 ($p = 0.02$) and 2.66 ($p < 0.00$) more likely to fall risk (Table 3).

Table 3. Logistic regression of the association between fall risk and the EFS domains of older adult participants

ESF domains	OR	Fall risk	
		CI	p-value*
Functional independence			
0 - 1 activities	1.00	-	-
2 - 4 activities	2.23	1.23 - 4.06	0.00
5 - 8 activities	4.52	2.22 - 9.18	0.00
Medication use			
Do you use of five or more medications?			
Yes	2.23	1.33 - 3.73	0.00
No	1.00	-	-
Do you sometimes forget to take your medication?			
No	1.00	-	-
Yes	1.92	1.11 - 3.30	0.01
Mood - Sad/depressed			
No	1.00	-	-
Yes	1.79	1.06 - 3.02	0.02
Functional performance - TUG			
0 to 10 seconds	1.31	0.70 - 2.46	0.39
11 to 20 seconds	1.00	-	-
More than 20 seconds	2.66	1.40 - 5.03	0.00

R² - 0.31; OR - Odds Ratio; CI - Confidence Interval

Discussion

Fall risk is associated with and is more likely to occur in older adults over 70 years of age and diagnosed with four or more previous illnesses. This risk is also associated with older adults without work activity, possibly occurring more with those who live alone.

A Brazilian observational study reports a higher prevalence and association with the occurrence of falls among older adults aged 70 years or older.⁽¹⁷⁾ It is assumed that the advanced decline in physical, sensory and cognitive functions resulting from aging contribute to this development.

The relationship found in fall risk in older adults with no work activity is also evidenced in a Korean study with 31,684 participants. Older adults with work occupation tend to have lower fall risks, as they are better able to carry out daily activities. Moreover, they have more opportunities for social interaction, which can prevent isolation and depres-

sion.⁽⁶⁾ These factors may reduce fall risk in these individuals.

This same study also associates fall risk with living arrangements, indicating that older adults who live alone are at greater risk for such events.⁽⁶⁾ This fact presupposes that people who share the house with older adults can minimize fall risk at home, such as the use of inappropriate clothes and shoes, presence of rugs, uneven floors, disorganized environments, objects scattered on the floor and loose animals.⁽⁴⁾

The presence of multiple chronic diseases constitutes another important association, confirming the data evidenced in a research carried out in Finland, in which older adults with five chronic diseases present 11.7 times greater possibility of falls, since patterns of morbidities are associated with the presence of inability.^(18,19)

Among these patterns, depression is understood as one of the predictors of severe fatigue, aggravating physical conditions and, consequently, limiting daily activities.⁽¹⁹⁾ In this perspective, a Brazilian cross-sectional study reports that older adults with depressive symptoms are more likely to suffer falls compared to those who do not have such symptoms. Knowing that body falls result from the interaction between physical factors as well as contextual factors, depressive symptoms become a risk factor for falls in older adults.⁽²⁰⁾

The association between cognitive decline and the occurrence of falls corroborates a Brazilian cross-sectional study, demonstrating that cognitive impairment can influence the occurrence of recurrent falls in older adults.⁽²¹⁾ It is known that cognitive decline is associated with limitations in activities of daily living, in which older adults who are dependent on these activities are five times more likely to have a cognitive deficit.⁽²²⁾ Therefore, cognitive impairment is associated with functional decline, which, in turn, predisposes to the occurrence of falls. In this sense, a Brazilian cross-sectional study highlights that the greater the functional dependence, the greater the fall risk, corroborating the findings of this study.⁽²³⁾

Health status and the number of medications used by older adults also increase the chances of falls

in these individuals, which can be explained by the possible increase in the occurrence of side effects and drug interactions, as a result of polypharmacy.⁽²⁴⁾

However, forgetting to use medication is still not a well-studied factor in the context of risk for falls. Possibly this omission is related to cognitive dysfunction, and not directly to the deprivation of a specific drug effect.

Negative self-perceived health is also associated with the occurrence of falls, aligned with a Brazilian cross-sectional study.⁽²⁵⁾ This association seems to be indirectly related to the occurrence of the frailty syndrome in older adults, since it was observed that general health status influences the determination of frailty in this population.⁽²⁶⁾ Considering this premise and knowing that the investigation of general health status includes the number of hospitalizations suffered by older adults, a cross-sectional study with 1,750 older adults reveals an association between frailty and hospitalization records in the last six months, as well as with the occurrence of falls in the last year.⁽²⁷⁾

The poor nutritional status of older adults has been discussed due to its high prevalence in individuals who fall.⁽²⁸⁾ A prospective cohort study showed that 46% of older adults at high risk for falls have a high risk of malnutrition.⁽²⁹⁾ This association is possibly verified by the concomitant presence of sarcopenia, causing musculoskeletal dysfunction, which may favor the occurrence of falls.

However, individuals with increases in nutritional status are not associated with improvement in gait speed through the TUG test.⁽²⁸⁾ On the other hand, considering that the TUG is a tool for measuring the physical mobility of frail older adults, providing information on balance, gait speed and functional capacity, it is significantly associated with fall risk, since the reduction in gait speed is related to episodes of falls in especially older adults.^(16,30)

The association of fall risk with the frailty syndrome corroborates with other studies already carried out. Brazilian cross-sectional study describes that 65.2 to 66.7% of older adults considered frail are at risk of falling.⁽³¹⁾ A systematic review concludes that older adults with frailty markers are 33

to 51% more likely to fall recurrently.⁽³²⁾ Thus, preventing the installation of the frailty syndrome in older adults can prevent the occurrence of falls in this population segment.

The present study presents as a limitation its cross-sectional design, not allowing to establish a causal relationship and longitudinal assessment of the phenomenon. However, it is capable of performing associations and comparisons, allowing the identification of associated factors.

The results pointed out may contribute to expanding knowledge about the relationship between fall risk and the frailty syndrome and sociodemographic variables in older adults, favoring the identification of these associations in care practice in order to minimize the impacts of these problems on older adult' health.

Conclusion

Fall risk is associated with factors related to the decline of physical, psychological and mental functions in older adults, which are exacerbated in the frailty syndrome.

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Collaborations

Dias ALP, Pereira FA, Barbosa CPL, Araújo-Monteiro GKN, Santos-Rodrigues RC and Souto RQ contributed to the project design, data analysis and interpretation, article writing, relevant critical review⁽³¹⁾ of intellectual content and final approval of the version to be published.

References

- Macena WG, Hermano LO, Costa TC. Alterações fisiológicas decorrentes do envelhecimento. *Rev Mosaicum*. 2018;15(27):223-36.
- Saftari LN, Kwon OS. Ageing vision and falls: a review. *J Physiol Anthropol*. 2018;37(11):1-14. Review.
- Jiang Y, Xia Q, Zhou P, Jiang S, Diwan VK, Xu B. Falls and Fall-Related Consequences among Older People Living in Long-Term Care Facilities in a Megacity of China. *Gerontology*. 2020;66(6):523-31.
- Teixeira DK, Andrade LM, Santos JL, Caires ES. Falls among the elderly: environmental limitations and functional losses. *Rev Bras Geriatr Gerontol*. 2019;22(3):e180229.
- Elias Filho J, Borel WP, Diz JB, Barbosa AW, Britto RR, Felício DC. Prevalence of falls and associated factors in community-dwelling older Brazilians: a systematic review and meta-analysis. *Cad Saude Publica*. 2019;35(8):e00115718.
- Kim T, Choi SD, Xiong S. Epidemiology of fall and its socioeconomic risk factors in community-dwelling Korean elderly. *PLoS One*. 2020;15(6):e0234787.
- Alabdullgader A, Rabbani U. Prevalence and risk factors of falls among the elderly in Unaizah City, Saudi Arabia. *Sultan Qaboos Univ Med J*. 2021;21(1):e86-93.
- Bartosch PS, Kristensson J, McGuigan FE, Akesson KE. Frailty and prediction of recurrent falls over 10 years in a community cohort of 75-year-old women. *Aging Clin Exp Res*. 2020;32(11):2241-50.
- Fried LP, Ferrucci L, Darer J, Williamson JD, Anderson G. Untangling the concepts of disability, frailty and comorbidity: implications for improved targeting and care. *J Gerontol A Biol Sci Med Sci*. 2004;59(3):255-63.
- Lee DR, Santo EC, Lo JC, Weintraub ML, Patton M, Gordon NP. Understanding functional and social risk characteristics of frail older adults: a cross-sectional survey study. *BMC Fam Pract*. 2018;19(1):170.
- Lourenço RA, Moreira VG, Mello RG, Santos IS, Lin SM, Pinto AL, et al. Brazilian consensus on frailty in older people: concepts, epidemiology and evaluation instruments. *Geriatr Gerontol Aging*. 2018;12(2):121-35.
- Lins ME, Marques AP, Leal MC, Barros RL. Frailty risk in community-dwelling elderly assisted in Primary Health Care and associated factors. *Saúde Debate*. 2019;43(121):520-9.
- Veras R, Dutra S. Perfil do idoso brasileiro: questionário BOAS. Rio de Janeiro: UERJ; 2008. 100 p.
- Costa-Dias MJ, Martins T, Araújo F. Study of the cut-off point of the Morse Fall Scale (MFS). *Rev Enf Ref*. 2014;4(1):63-72.
- Rolfson DB, Majumdar SR, Tsuyuki RT, Tahir A, Rockwood K. Validity and reliability of the Edmonton Frail Scale. *Age Ageing*. 2006;35(5):526-9.
- Podsiadlo D, Richardson S. The timed "Up & Go": a test of basic functional mobility for frail elderly persons. *J Am Geriatr Soc*. 1991;39(2):142-8.
- Carvalho MS, Martins P, Santos FS, Queiroz DT. Falls in community dwelling elderly assisted by a family health strategy in the municipality of São Leopoldo: prevalence and associated factors. *Acta Fisiatr*. 2021;28(4):259-67.
- Immonen M, Haapea M, Similä H, Enwald H, Keränen N, Kangas M, et al. Association between chronic diseases and falls among a sample of older people in Finland. *BMC Geriatr*. 2020;20:225.
- Schmidt TP, Wagner KJ, Schneider IJ, Danielewicz AL. Padrões de multimorbidade e incapacidade funcional em idosos brasileiros: estudo transversal com dados da Pesquisa Nacional de Saúde. *Cad Saude Publica*. 2020;36(11):e00241619.
- Fontanela LC, Souza LF, Leopoldino AO, Danielewicz AL, Avelar NC. A Escala de Depressão Geriátrica pode ser usada para rastrear quedas em idosos da comunidade?. *Acta Fisiatr*. 2021;28(1):43-8.
- Fallaci IV, Fabrício DM, Alexandre TD, Chagas MH. Association between falls and cognitive performance among community-dwelling older people: a cross-sectional study. *Sao Paulo Med J*. 2022;140(3):422-9.
- Santos BP, Amorim JS, Poltronieri BC, Hamdan AC. Association between functional disability and cognitive deficit in hospitalized elderly patients. *Cad Bras Ter Ocup*. 2021;29:e2101.
- Paula JG, Gonçalves LH, Nogueira LM, Delage PE. Correlation between functional independence and risk of falls in older adults at three long-term care facilities. *Rev Esc Enferm USP*. 2020;54:e03601.
- Sharif SI, Al-Harbi AB, Al-Shihabi AM, Al-Daour DS, Sharif RS. Falls in the elderly: assessment of prevalence and risk factors. *Pharm Pract (Granada)*. 2018;16(3):1206.
- De Sousa-Araújo IV, C Gomes N, Santos-Nascimento J, Neves Romanato Ribeiro CC, Dos Santos Tavares DM. Queda entre idosos: preditores e distribuição espacial. *Rev Salud Publica (Bogota)*. 2019;21(2):187-194.
- Araújo Júnior FB, Machado IT, Santos-Orlandi AA, Pergola-Marconato AM, Pavarini SC, Zazzetta MS. Frailty, profile and cognition of elderly residents in a highly socially vulnerability area. *Cien Saude Colet*. 2019;24(8):3047-55.
- Maia LC, Moraes EN, Costa SM, Caldeira AP. Fragilidade em idosos assistidos por equipes da atenção primária. *Cien Saude Colet*. 2020;25(12):5041-50.
- Conzade R, Phu S, Vogrin S, Bani Hassan E, Sepúlveda-Loyola W, Thorand B, et al. Changes in nutritional status and musculoskeletal health in a geriatric post-fall care plan setting. *Nutrients*. 2019;11(7):1551.
- Eckert C, Gell NM, Wingood M, Schollmeyer J, Tarleton EK. Malnutrition risk, rurality, and falls among community-dwelling older adults. *J Nutr Health Aging*. 2021;25(5):624-27.
- Lenardt MH, Setoguchi LS, Betiolli SE, Grden CR, Sousa JA, Lourenço TM. Gait speed and occurrence of falls in the long-lived elderly. *Rev Min Enferm*. 2019;23:e1190.
- Giacomini SB, Fhon JR, Rodrigues RA. Frailty and risk of falling in the older adult living at home. *Acta Paul Enferm*. 2020;33:eAPE20190124.
- Jehu DA, Davis JC, Falck RS, Bennett KJ, Tai D, Souza MF, et al. Risk factors for recurrent falls in older adults: a systematic review with meta-analysis. *Maturitas*. 2021;144:23-8.