Original Article

TEXTO & CONTEXTO ENFERMAGEM
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FACTORS PREDICTING HOSPITAL ADMISSION AND DEATH IN OLDER ADULTS WITH COGNITIVE IMPAIRMENT: A LONGITUDINAL STUDY

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ABSTRACT

Objective: to identify sociodemographic factors, clinical conditions and sarcopenia parameters that predict hospital admission and death in older adults with cognitive impairment.
Method: this is a longitudinal observational study carried out with 170 older adults with cognitive impairment assessed between 2019 and 2021. Predictor variables were sociodemographic characteristics, clinical conditions and sarcopenia parameters. Sarcopenia was operationalized through handgrip muscle strength (dynamometry), muscle mass (calf circumference) and the Timed Up and Go test. Occurrence of hospital admission and death within one year after assessment of older adults were the predicted variables. Analyzes were carried out using descriptive statistics, independent Student' t-test, Mann-Whitney U test, chi-square test and univariate logistic regression.
Results: most participants were female (±77.57 years old), with low education, sedentary, 15.9% with sarcopenia and 13% with a history of hospital admission. It was identified that education level had an effect on occurrence of hospital admission (U=1,423.5, p=0.027) and death (U=647.0, p=0.025) within one-year follow-up. Furthermore, there is an association between history of hospital admission in the last 6 months and occurrence of hospital admission [$\chi^2(1)=4.729$; p=0.030] and death [$\chi^2(1)=3.919$; p=0.048] within one year follow-up. It was identified that history of hospital admission in the last 6 months was associated with occurrence of hospital admission within one-year follow-up (OR=2.963; 95%CI 1.076–8.165, p=0.036).
Conclusion: history of hospital admission in the last six months is associated with occurrence of hospital admission over a year in older adults with cognitive impairment.

DESCRIPTORS: Aged. Risk Factors. Hospital Admission. Mortality. Cognitive Deficit.

HOW CITED: Barros RS, Teixeira GTM, Pinto JM, Sampaio RX, Mendes FAS, Garcia PA. Factors predicting hospital admission and death in older adults with cognitive impairment: a longitudinal study. Texto Contexto Enferm [Internet]. 2024 [cited YEAR MONTH DAY]; 33:e20230149. Available from: https://doi.org/10.1590/1980-265X-TCE-2023-0149en

FATORES PREDITORES DE HOSPITALIZAÇÃO E ÓBITO EM IDOSOS COM COMPROMETIMENTO COGNITIVO: UM ESTUDO LONGITUDINAL

RESUMO

Objetivo: identificar fatores sociodemográficos, condições clínicas e parâmetros de sarcopenia preditores de hospitalização e óbito em idosos com comprometimento cognitivo.
Método: estudo observacional longitudinal realizado com 170 idosos com comprometimento cognitivo avaliados entre 2019 e 2021. As variáveis preditoras foram características sociodemográficas, condições clínicas e parâmetros de sarcopenia. A sarcopenia foi operacionalizada por meio da força muscular de preensão palmar (dinamometria), da massa muscular (circunferência da panturrilha) e do teste *Timed Up and Go*. A ocorrência de hospitalização e óbito até um ano após a avaliação do idoso configuraram as variáveis preditas. Procedeu-se análises por estatística descritiva, testes t-student independente, U Mann Whitney, Qui-Quadrado e de regressão logística univariada.
Resultados: a maioria dos participantes era do sexo feminino (±77,57 anos), de baixa escolaridade, sedentários,15,9% com sarcopenia e 13% com histórico de internação. Foi identificado que o nível de escolaridade teve efeito sobre a ocorrência de hospitalização (U=1423,5, p=0,027) e de óbito (U=647,0, p=0,025) no seguimento de um ano. Além disso, há associação do histórico de internação nos últimos 6 meses com a ocorrência de hospitalização [$\chi^2(1)=4,729$; p=0,030] e de óbito [$\chi^2(1)=3,919$; p=0,048] no seguimento de um ano. Identificou-se que o histórico de internação nos últimos 6 meses associou-se com a ocorrência de hospitalização em um ano de seguimento (OR=2,963; IC95%1,076–8,165, p=0,036).
Conclusão: o histórico de internação nos últimos seis meses está associado à ocorrência de hospitalização ao longo de um ano em idosos com comprometimento cognitivo.

DESCRITORES: Idoso. Fatores de risco. Hospitalização. Mortalidade. Déficit Cognitivo.

FACTORES PREDICTIVOS DE HOSPITALIZACIÓN Y MUERTE EN ANCIANOS CON DETERIORO COGNITIVO: UN ESTUDIO LONGITUDINAL

RESUMEN

Objetivo: identificar factores sociodemográficos, condiciones clínicas y parámetros de sarcopenia que predicen la hospitalización y la muerte en personas mayores con deterioro cognitivo.
Método: estudio observacional longitudinal realizado con 170 personas mayores con deterioro cognitivo evaluados entre 2019 y 2021. Las variables predictoras fueron las características sociodemográficas, las condiciones clínicas y los parámetros de sarcopenia. La sarcopenia se puso en práctica mediante la fuerza de los músculos de prensión manual (dinamometría), la masa muscular (circunferencia de la pantorrilla) y la prueba Timed Up and Go. La ocurrencia de hospitalización y muerte dentro del año posterior a la evaluación del anciano configuró las variables predichas. Los análisis se realizaron mediante estadística descriptiva las pruebas t de Student independiente, U de Mann-Whitney, chi-cuadrado y regresión logística univariada.
Resultados: la mayoría de los participantes fueron del sexo femenino (±77,57 años), con bajo nivel educativo, sedentarios, el 15,9% con sarcopenia y el 13% con antecedentes de hospitalización. Se identificó que el nivel de escolaridad tuvo efecto en la ocurrencia de hospitalización (U=1.423,5, p=0,027) y muerte (U=647,0, p=0,025) al año de seguimiento. Además, existe asociación entre el antecedente de hospitalización en los últimos 6 meses y la ocurrencia de hospitalización [$\chi^2(1)=4,729$; p=0,030] y muerte [$\chi^2(1)=3,919$; p=0,048] al año de seguimiento. Se identificó que el antecedente de hospitalización en los últimos 6 meses se asoció con la ocurrencia de hospitalización en un año de seguimiento (OR=2,963; IC95%1,076–8,165, p=0,036).
Conclusión: un antecedente de hospitalización en los últimos seis meses se asocia con la ocurrencia de hospitalización mayor a un año en personas mayores con deterioro cognitivo.

DESCRIPTORES: Anciano. Factores de Riesgo. Hospitalización. Mortalidad. Déficit Cognitivo.

INTRODUCTION

Older adults with cognitive impairment are often complex patients and therefore at high risk of hospital admissions and mortality. Cognitive impairment is characterized by the decline in the normal functioning of one or more brain functions, such as attention, reasoning and memory, which compromises the performance of activities of daily living (ADLs)[1]. Older adults with cognitive impairment have a 2.86-fold increased risk of falling[2], 1.71-fold increased risk of developing functional disability and sarcopenia[3], up to a five-fold increased risk of mortality[4], and are more susceptible to hospital admission[5–6].

Hospital admission is a threatening event for older adults, as it is associated with a greater risk of functional decline and disability, which together contribute to an increase in adverse clinical outcomes and problems in the post-hospital discharge rehabilitation process[7,8]. There is strong evidence that hospital admission and death are associated with sarcopenia in older adults with cognitive impairment[3–9]. During hospital admission, muscle degradation pathways are activated, responsible for providing proteins that are used as a source of energy to deal with acute health problems, leading to loss of strength and muscle mass associated with functional declines observed in the short and long term[10]. In this context, studies have shown that the inability to perform specific functional activities, such as leaving home, self-care, instrumental and basic ADLs are often present up to 6 months after hospital discharge and are often followed by anxiety and social fragility[8]. Therefore, such commitments can generate irreversible consequences on older adults' physical, psychological and social health and increase the chance and severity of a new hospital admission, contributing to a greater chance of early mortality[8,10–11].

Although risk factors for hospital admission and mortality are extensively studied in older adults in general, those with cognitive impairment are often excluded from research without justification or mention of this exclusion as a limitation of this study, which may reduce the clinical usefulness of several findings. Some studies have shown that older adults with cognitive impairment are more susceptible to hospital admission and consequently have a higher risk of death due to the deleterious effects of cognitive loss, which affects language expression, execution of tasks, perception of symptoms and deficits in perceptual functions[5–6]. Thus, studies have shown that reductions of one point per year in the Mini Mental State Examination (MMSE) increase the risk of death by 11%. Furthermore, there is an association between the rate of change in the MMSE score and mortality so that the greater the cognitive decline, the greater the risk of death. Thus, patients with rapid cognitive decline can have mortality rates up to 75% higher than older adults in general[6]. Research has also shown that older adults with cognitive impairment have a higher risk of hospital admissions. The hospital admission rate increases by 9.7% per year and can increase by 32.7% for each point less in the global cognitive score in the first years and 24.3% later, in addition to increasing by 3% for each point less in the MMSE[5]. Furthermore, like the risk of death, hospital admission rates increase in patients with lower cognitive function and in those whose rates of cognitive decline are more rapid[5].

In this context, the primary objective of this study was to identify sociodemographic factors, sarcopenia parameters and clinical conditions that predict hospital admission and death in older adults with cognitive impairment in specialized care in the public health system. And the secondary objective of this study was to verify the accuracy of these factors in predicting the risk of hospital admission and death within one-year follow-up.

METHOD

This is an observational, longitudinal and prospective study carried out at a geriatrics service of the Western Health Region of the Federal District, Brazil. The study design followed STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) recommendations[12]. All participants provided written informed consent, and the study received ethical approval from the Research Ethics Committee (REC).

The study consisted of a convenience sample. Study participants were recruited from among older adults admitted to geriatrics service of the Western Health Region of the Federal District and who underwent a comprehensive geriatric assessment from 2019 to 2021. Older adults (≥ 60 years old), with cognitive impairment, who lived in community environments, from which it was possible to obtain sociodemographic, clinical information and at least one of the sarcopenia parameter measurements, were included in the research. Cognitive status was assessed using the MMSE when older adults were admitted to a geriatrics service. This assessment was carried out by the unit's nurse and undergraduate physical therapy students duly trained for the research. Cognitive impairment was defined as a score lower than recommended, depending on education. Participants with more than seven years of education who scored <28 points, those with between four and seven years of education who totaled <24 points, education between one and three years who totaled <23 points and those who were illiterate who totaled <19 points were classified as having cognitive impairment[13].

Sample size was estimated through sample calculation using the Gpower 3.1.5 program. Considering an Odds Ratio (OR) of 3.3 identified in analyzes of the association between physical impairment and hospital admission (OR=3.3; 95% CI: 1.7-6.5)[14], and aiming for a power of 95% and an alpha error of 0.05, a sample size of 71 older adults was estimated for a two-tailed test. An n of 20% was added to the estimated sample size, in order to compensate for possible losses, totaling a minimum sample size of 85 participants for the present study.

The predictor variables (independent variables) of this study were sociodemographic characteristics, clinical conditions and sarcopenia parameters identified at the time of reception of older adults (baseline data). This baseline data was collected from medical records of older adults assisted in the reception service from 2019 to 2021.

The sociodemographic characteristics investigated were age (completed years), sex (female or male) and education (years of study). The clinical conditions investigated were regular physical exercise (at least 150 minutes per week of moderate-intensity activity)[15], Body Mass Index (BMI), self-reported illnesses (heart disease, stroke, dyslipidemia, diabetes, high blood pressure, dementia and depression), number of medications for continuous use (checked through medical prescriptions) and history of hospital admissions in the last six months (occurrence of 1 or more hospital admissions).

The clinical parameters of sarcopenia were assessed and defined according to Cruz-Jentoft *et al*.[16]. Muscle strength was obtained through the average of three measurements obtained with a handgrip dynamometer (HGS) on the dominant upper limb[17]. This is a valid instrument with excellent test-retest reliability for use in older adults with questionable to moderate dementia[17]. Muscle weakness was identified for values <27 Kgf for men and <16 Kgf for women[16]. As the data were collected in basic health units, muscle mass was obtained by measuring the calf circumference (CC), using a non-elastic measuring tape, with older adults sitting, legs and ankles positioned at 90º. Measurements smaller than 31 centimeters (cm) characterized low muscle mass[16]. The Timed Up and Go (TUG) test was used as a measure of physical performance. Participants stood up from an armless chair, walked a distance of three meters at their usual pace, turned 180º and returned in the same direction until sitting down again. Test execution was timed and those who performed TUG in ≥20 seconds were considered to have low physical performance[16]. The TUG test is a reliable instrument for measuring

physical performance in older adults[18]. Older adults were categorized as non-sarcopenic when they had normal HGS values; likely sarcopenic, when they had low HGS; sarcopenic, when in addition to low HGS they had low muscle mass assessed by CC; or severe sarcopenic, when in addition to low strength and low muscle mass, they also presented a low performance in TUG according to this information[16].

The predicted variables (dependent variables) of this study were hospital admission and death from all causes up to one year after admission of older adults (longitudinal data). Hospital admission was defined as occurrence of hospital admission or hospital admission in an Emergency Care Unit for at least 24 hours in the year following the assessment carried out at reception. This variable was collected in a dichotomous form (yes/no) in the SES-DF Track Care system and in the *Sistema de Informação Hospitalar do Sistema* Único *de Saúde* (SIH-SUS – Brazilian Health System Hospital Information System). For the analyses, the older adults in the study were grouped into older adults who were or were not admitted to hospital within one-year follow-up. Death data in the year following the assessment carried out at reception were collected from patients' medical record using Track Care and *Sistema de Informação sobre Mortalidade do Ministério da Saúde* (SIM-MS – Ministry of Health Mortality Information System), using the name of older adults and their mothers. This variable was collected in dichotomous form (yes/no). The older adults in the study were grouped into older adults who died and who did not die during follow-up. The collection of this information from outpatient records and health systems (TrackCare, SIH-SUS and SIM-M) took place between May and December 2022.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 23.0 and G.Power version 3.1. Descriptive statistics were performed with mean, median, standard deviation, interquartile range [25% and 75% percentiles]), absolute frequency and percentage. The distribution of numerical data was analyzed using the Kolmogorov-Smirnov test. The frequencies of hospital admissions or deaths were calculated using the number of cases of hospital admissions or deaths and the total number of older adults studied. To compare predictors with numerical data between the study groups, the Mann-Whitney U test (data with non-normal distribution) and independent Student's t-test (data with normal distribution) were used, and for those with categorical data, the chi-square test was used. Univariate logistic regressions were performed on independent variables that remained significant in comparison analyzes with occurrence of hospital admission and death (dependent variables). The assumptions for logistic regression analysis, such as absence of multicollinearity, absence of outliers and minimum number of cases in each variable, were analyzed. ORs with 95% confidence intervals were calculated for each independent variable. To analyze the accuracy of associated factors to predict hospital admission and death, sensitivity (S), specificity (Sp), positive predictive value (PPV) and negative predictive value (NPV) were calculated. S and Sp values were considered adequate if they were greater than 50%, with values from 51% to 69% representing poor accuracy and values above 70% representing good accuracy. A significance level of 5% was considered.

RESULTS

All older adults assessed in the reception service between 2019 and 2021 were subject to eligibility criterion assessment. In total, 488 older adults underwent the initial research screening. Of these, 318 were excluded for not presenting complete data or for not showing cognitive impairment. Analyzes were carried out with 170 participants, from whom information was collected on hospital admission and death occurring during the 12 months following the baseline assessment (Figure 1).

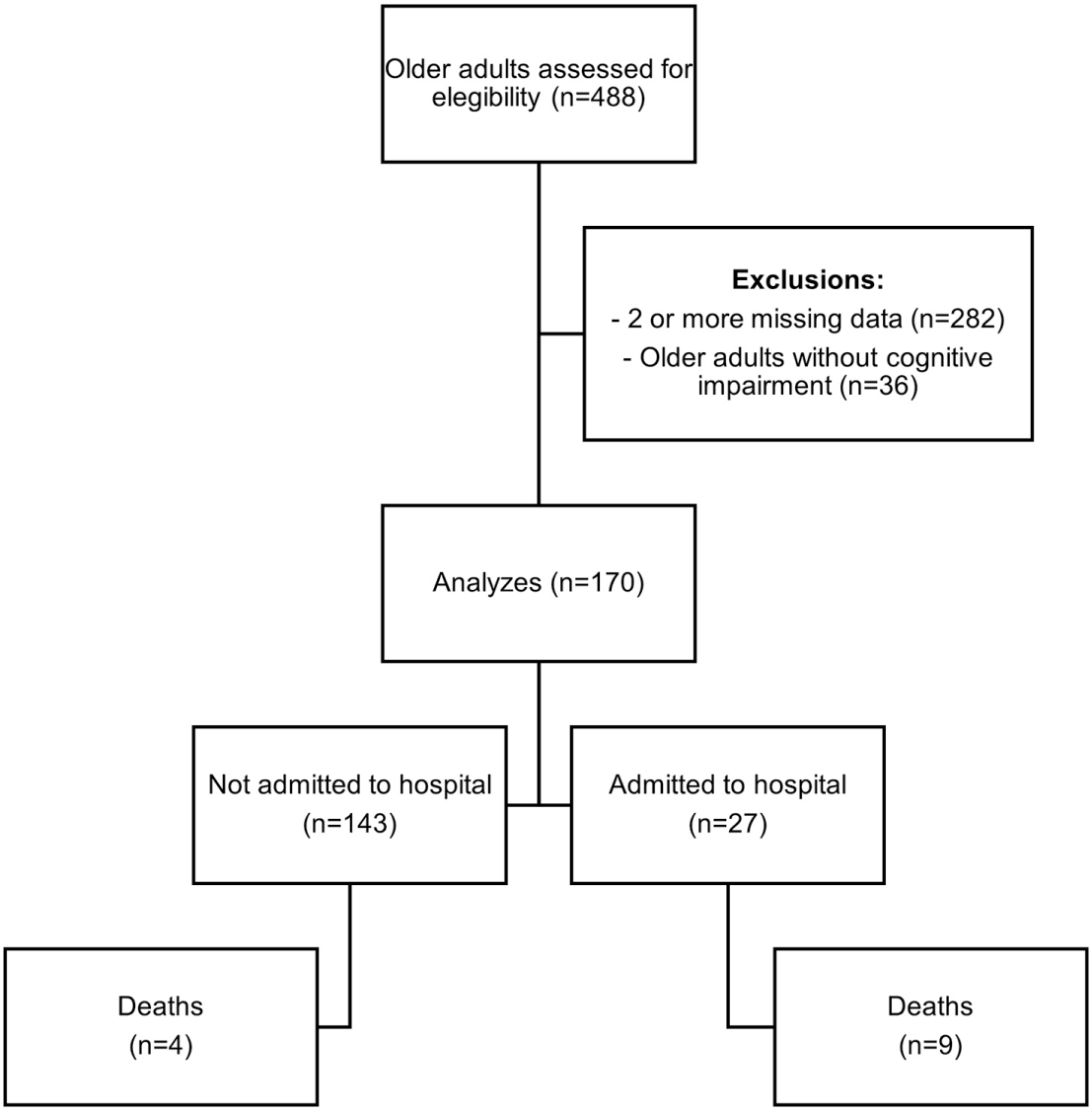

Figure 1 – Flowchart of sample collection and monitoring of study participants, Brasília, FD, Brazil, 2019-2022.

Of the 170 participants, most were female, with a mean age of 77.57 years, low education, sedentary, 15.9% had confirmed sarcopenia and 13% had a history of previous hospital admission. Older adults had a median of 17 points in the MMSE (P25%-P75% =13 – 20). During the one-year follow-up after the baseline assessment, hospital admission was observed in 15.9% (n=27) of older adults and death in 7.6% (n=13). Older adults with hospital admission during follow-up had a median of one hospital admission in the year of follow-up (P25%-P75% = 1 – 1).

Comparisons of sociodemographic and clinical characteristics and sarcopenia parameters between older adults with and without hospital admission and between older adults with and without death outcome during follow-up are presented in Tables 1 and 2, respectively. The Mann-Whitney U test showed that education level has an effect on occurrence of hospital admission (U=1423.5, p=0.027) and death (U=647.0, p=0.025) following a year. The chi-square test of independence showed that there is an association between history of hospital admission in the last 6 months and occurrence of hospital admission [$\chi^2(1)=4.729$; p=0.030] and death [$\chi^2(1)=3.919$; p=0.048] within one year follow-up.

Table 1 – Comparison of sociodemographic, clinical characteristics and sarcopenia parameters between groups of older adults according to occurrence of hospital admissions within a one-year follow-up, Brasília, Federal District, 2019-2022 (n=170).

Characteristics	Hospital admission (n=170)		
	Older adults not admitted to hospital	Older adults admitted to hospital	p-value
Sociodemographic			
Sex †			
Female	75.5 (108)	66.7 (18)	0.345
Male	24.5 (35)	33.3 (9)	
Age (years)‡	77.94 (7.82)	75.63 (6.28)	0.150
Years of study §	3 [0 – 4]	1 [0 – 4]	0.027*
Clinics			
Physical exercise (yes)†	12.6 (18)	18.5 (5)	0.373
BMI, kg/m²‡	27.67 (5.79)	28.77 (6.06)	0.370
Heart diseases†	32.2 (46)	40.7 (11)	0.384
Hypertension†	81.8 (117)	85.2 (23)	0.789
Dyslipidemia†	45.5 (65)	37.0 (10)	0.527
Diabetes†	45.5 (65)	63.0 (17)	0.141
Stroke†	19.6 (28)	14.8 (4)	0.789
Insanity†	30.1 (43)	37.0 (10)	0.501
Depression†	44.1 (63)	48.1 (13)	0.833
Medications§	5 [3 – 7]	5 [4 – 7.5]	0.410
History of hospital admission (yes)†	10.6 (15)	25.9 (7)	0.030*
Sarcopenia parameters			
Muscle strength (Kgf) §	18 [12.83–21.33]	18.66 [13.66–22.81]	0.714
Normal muscle strength†	53.1 (76)	48.1 (13)	0.678
Low muscle strength†	46.9 (67)	51.9 (14)	
Muscle mass, cm§	32 [28–35]	30 [29 – 34]	0.307
Normal muscle mass†	59.4 (85)	44.4 (12)	0.203
Low muscle mass†	40.6 (58)	55.6 (15)	
Physical performance§	14.64 [11.88–20.15]	13.45 [11.68–17.87]	0.341
Good physical performance†	74.1 (106)	85.2 (23)	0.326
Low physical performance†	25.9 (37)	14.8 (4)	
Sarcopenia†			
Absence of sarcopenia	53.1 (76)	48.1 (13)	0.181
Probable sarcopenia	23.8 (34)	14.8 (4)	
Confirmed sarcopenia	13.3 (19)	29.6 (8)	
Severe sarcopenia	9.8 (14)	7.4 (2)	

*p<0.05. †Percentage frequency (absolute frequency) compared with the chi-square test. ‡Normal distribution, mean (standard deviation) compared with independent Student's-test. §Non-normal distribution, median (P25-75) compared with Mann-Whitney U test. BMI: Body Mass Index (kg/m^2).

Table 2 – Comparison of sociodemographic, clinical characteristics and sarcopenia parameters between groups of older adults according to occurrence of death within a one-year follow-up, Brasília, Federal District, 2019-2022 (n=170).

Characteristics	Death (n=170)		p-value
	Older adults who did not die	Older adults who died	
Sociodemographic			
Sex†			
Female	73.9 (116)	76.9 (10)	0.810
Male	26.1 (41)	23.1 (3)	
Age (years)‡	77.48 (7.77)	78.69 (5.82)	0.583
Years of study§	3 [0 – 4]	0 [0 – 2]	0.025*
Clinics			
Physical exercise (yes)†	13.4 (21)	15.4 (2)	0.690
BMI, kg/m²‡	27.64 (5.61)	30.34 (7.91)	0.248
Heart diseases†	33.1 (52)	38.5 (5)	0.763
Hypertension†	80.9 (127)	100.0 (13)	0.128
Dyslipidemia†	45.9 (72)	23.1 (3)	0.149
Diabetes†	47.8 (75)	53.8 (7)	0.776
Stroke†	19.1 (30)	15.4 (2)	0.741
Insanity†	33.1 (52)	7.7 (1)	0.066
Depression†	45.9 (72)	30.8 (4)	0.389
Medications§	5 [3 – 7]	7 [3 – 8]	0.458
History of hospital admission (yes)†	11.5 (18)	30.8 (4)	0.048*
Sarcopenia parameters			
Muscle strength (Kgf)§	18 [12.67–21.66]	18 [15.33–22.63]	0.925
Normal muscle strength†	52.9 (83)	46.2 (6)	0.775
Low muscle strength†	47.1 (74)	53.8 (7)	
Muscle mass, cm§	32 [28 – 35]	34 [30 – 37]	0.143
Normal muscle mass†	56.7 (89)	61.5 (8)	0.780
Low muscle mass†	43.3 (68)	38.5 (5)	
Physical performance§	14.06 [11.77–19.80]	19.08 [12.55–27.37]	0.130
Good physical performance†	76.4 (120)	69.2 (9)	0.517
Low physical performance†	23.6 (37)	30.8 (4)	
Sarcopenia†			
Absence of sarcopenia	52.9 (83)	46.2 (6)	0.506
Probable sarcopenia	21.7 (34)	30.8 (4)	
Confirmed sarcopenia	15.3 (24)	23.1 (3)	
Severe sarcopenia	10.2 (16)	0.0 (0)	

*p<0.05. †Percentage frequency (absolute frequency) compared with the chi-square test. ‡Normal distribution, mean (standard deviation) compared with independent Student's-test. §Non-normal distribution, median (P25-75) compared with Mann-Whitney U test. BMI: Body Mass Index (kg/m²).

Univariate logistic regression analysis identified that history of hospital admission in the last 6 months was associated with occurrence of hospital admission in one-year follow-up (OR = 2.963; 95%CI 1.076 – 8.165, p=0.036). The associations of education level with occurrence of hospital

admission and death during follow-up and history of hospital admission with occurrence of death during follow-up did not remain significant in univariate logistic regression analyzes (Table 3).

Table 3 – Univariate logistic regression analyzes of sociodemographic and clinical characteristics and sarcopenia parameters (independent variables) with occurrence of hospital admission and death during follow-up (dependent variables), Brasília, Federal District, Brazil, 2019-2022 (n=170).

Variables	Hospital admission		Death	
	OR [95% CI]	ß	OR [95% CI]	ß
Years of study †	0.846 (0.715 – 1.000)	-0.168	0.755 (0.568 – 1.002)	-0.281
History of hospital admission (yes)‡	2.963 (1.076 – 8.165)	1.086	3.407 (0.951 – 12.208)	1.226

* p<0.05. †Numerical data. ‡Categorical data.

In the accuracy analyses, considering history of hospital admission, a S of 26% and a Sp of 89% were identified to predict hospital admission within a one-year follow-up. Validity estimates are presented in Table 4.

Table 4 – Validity estimates of history of hospital admission to predict occurrence of hospital admission within a one-year follow-up, Brasília, Federal District, Brazil, 2019-2022 (n=170).

Variable	Cut-off	S* (%)	Sp† (%)	PPV‡ (%)	NPV§ (%)	Global accuracy
History of hospital admission	Yes	26%	89%	32%	86%	79%

* Sensitivity; †Specificity. ‡Positive predicted value; §Negative predictive value.

DISCUSSION

The present study aimed to identify sociodemographic factors, clinical conditions and sarcopenia parameters that predict hospital admission and death in older adults with cognitive impairment cared for by a specialized care service in the public health system. The main findings of this study were that, in older adults with cognitive impairment, a low education level and a history of hospital admission in the last six months are associated with a higher occurrence of hospital admission and death within one-year follow-up. History of hospital admission stood out as a predictor of readmission within a year. Furthermore, the results also demonstrated that history of hospital admission information is valid for screening the risk of readmission within one year in this population.

We identified that a low education level was associated with occurrence of death and hospital admissions within one year, although these associations were not maintained after univariate regression analysis. Our findings are in line with studies that identified an inversely proportional relationship between education level and mortality in older adults, pointing out that illiteracy is associated with a 2.79 times greater chance of death from all causes, even though such studies have not investigated this association specifically in older adults with cognitive impairment[11,19]. Studies have shown that education is directly related to greater access to health resources and services, which are associated with better health and longer survival. It is also believed that higher educational levels help individuals build better support networks that encourage participation in activities with greater cognitive demand and the adoption of healthy lifestyle habits. However, it is worth highlighting that current studies show that although there is a relationship between education and mortality, there are other socioeconomic factors more directly associated with mortality such as economic status. Furthermore, most studies

considered that the strength of association between education and mortality decreases at older ages because with aging the biological process has greater dominance over social determinants[19].

The present study identified that older adults with cognitive impairment who were admitted to hospital and who died within a year of follow-up had, at baseline, a higher frequency of hospital admission in the last six months. It also identified that history of hospital admission remained a predictor of new hospital admissions, increasing the chance of readmissions in a period of one year by almost three times. Our findings are consistent with previous studies that indicate that previous hospital admission constitutes a risk factor for new hospital admission and that it increases the chance of older adults in general dying from 1.8 to 3 times[7,8,20–22]. This relationship can be explained by complications linked to the original disease that result in important sequels associated with loss of functionality after hospital discharge[7,8,20,21]. Additionally, because older adults with cognitive impairment have difficulty expressing, understanding and executing commands, there may be an increase in inactivity in the hospital and impairment of hospital stay during hospital admission[23]. Then, continuing the patients' recovery process, it was identified that adherence to the post-hospital discharge rehabilitation process tends to be incomplete, slow and late, and may be related to worsening health conditions and a reduced chance of recovery; therefore, older adults with cognitive impairment may be subject to a cycle of functional decline that culminates in the recurrence of readmissions[7,8,10,24].

Furthermore, our study also verified the accuracy of history of hospital admission to predict readmission within a year in older adults with cognitive impairment. We observed that 89% of older adults who were not admitted to hospital during follow-up denied a previous history of hospital admission, and that among older adults who denied a history of hospital admission, 86% actually did not undergo hospital admission during the one-year follow-up. However, this tool presented low S and low PPV, and should be analyzed with caution, as it accurately identifies older adults who will not be admitted to hospital within a year among those who do not have a history of previous hospital admission; however, it is not capable of satisfactorily screening older adults who have already been hospitalized and predicting a new hospitalization within a year in this population. In this regard, history of hospital admission can be used as a clinical indicator to increase the assertiveness and safety of a counter-referral to a Basic Health Unit for older adults who do not have a history of hospital admission, providing theoretical basis for grading the urgency and need for care specialized in older adults with cognitive impairment. Furthermore, in addition to having high Sp and high NPV, history of hospital admission is quickly accessible and low cost, making it a tool that could be easily implemented in the care of the most diverse health services.

Our results showed no association between sarcopenia parameters and diagnosis with occurrence of hospital admission and death within one-year follow-up. Our findings contradict the results of a recent systematic review that showed that older adults with sarcopenia are twice as likely to be admitted to hospital when compared to those without sarcopenia, regardless of diagnostic criteria, and that highlighted the importance of designing preventive and effective strategies against sarcopenia to avoid hospital admissions of older adults[25]. They also contradict previous research that pointed to sarcopenia as a predictor of all-cause mortality among older adults living in the community[26]. However, the lack of significance of these relationships in the present study can be justified by the short follow-up period. Studies indicate that higher hospital admission rates are associated with a period of at least three years of follow-up and that shorter periods do not reveal this association. Moreover, higher death rates associated with sarcopenia presented follow-up periods of 3 to 14.4 years[25,26].

As strengths, this study had a longitudinal design, making it possible to identify causal relationships. It also investigated factors associated with hospital admission and death in specialized care setting and specifically included older adults with cognitive impairment, a group that is generally excluded in the vast majority of studies. The feedback feature of SIM-MS used to collect death

occurrences provided accuracy in searches, even when older adults died in another state or in a private network. As limitations, although the sample size respects the reference for the analyzes proposed in the study, an increase in the sample size could determine the significance of the other relationships investigated through logistic regression[27]. We also used CC to measure muscle mass and, despite the strong correlation with the skeletal muscle mass index in both sexes[28], this tool has been questioned. It is necessary to recognize the possibility of losing data on hospital admission when collected by SIH-SUS, which only searches older adults admitted to hospital in the public health network, even when under an agreement with the private network. Additionally, data on hospital admissions and deaths came from just one-year follow-up and we believe that at least twenty-four months would be a more appropriate assessment time for future studies.

By identifying that history of hospital admission is a predictor of new hospital admissions, the study contributes to screening older adults with cognitive impairment at greater risk of future hospital admissions. This finding reinforces the need for health professionals to provide support and closely monitor these older adults who were recently admitted to hospital and who present significant functional disabilities after hospital discharge, with an impact on transfers and mobility to leave home and access to care for conditions health chronicles. This is important information for nurses and multidisciplinary teams when planning the care provided to older adult patients to implement effective communication strategies at the time of discharge[29] and inclusion and adherence of these patients in the rehabilitation process after hospital discharge and, at the same time, provide a safer counter-referral to primary care.

CONCLUSION

This study showed that low education and a history of hospital admission in the last six months are associated with occurrence of hospital admission and death over a year in older adults with cognitive impairment. Among these factors, history of previous hospital admission stood out as a predictor of readmission and as a valid question for screening the risk of readmission among older adults with cognitive impairment. These findings reinforce the importance of recognizing these risk factors in older adults with cognitive impairment in order to implement early interventions aimed at preventing readmission and death.

REFERENCES

1. Drew DA, Weiner DE, Sarnak MJ. Cognitive impairment in CKD: Pathophysiology, management, and prevention. Am J Kidney Dis [Internet]. 2019 [cited 2023 Feb 23];74(6):782-90. Available from: https://doi.org/10.1053/j.ajkd.2019.05.017
2. Allali G, Launay CP, Blumen HM, Michele L Callisaya ML, De Cock AM, et al. Falls, cognitive impairment, and gait performance: Results from the GOOD Initiative. J Am Med Dir Assoc [Internet]. 2017 [cited 2023 Mar 15];18(4):335-40. Available from: https://doi.org/10.1016/j.jamda.2016.10.008
3. Peng TC, Chen WL, Wu LW, Chang YW, Kao TW. Sarcopenia and cognitive impairment: A systematic review and meta-analysis. Clin Nutr [Internet]. 2020 [cited 2022 Nov 1];39(9):2695-701. Available from: https://doi.org/10.1016/j.clnu.2019.12.014
4. Panza F, Lozupone M, Solfrizzi V, Sardone R, Dibello V, Di Lena L, et al. Different Cognitive Frailty Models and Health-and Cognitive-related Outcomes in Older Age: From Epidemiology to Prevention. J Alzheimers Dis [Internet]. 2018 [cited 2022 Feb 25];62(3):993-1012. Available from: https://doi.org/10.3233/JAD-170963
5. Wilson RS, Rajan KB, Barnes LL, Hebert LE, Mendes De Leon CF, Evans DA. Cognitive aging and rate of hospitalization in an urban population of older people. J Gerontol A Biol Sci Med Sci [Internet]. 2014 [cited 2023 Mar 28];69(4):447-54. Available from: https://doi.org/10.1093/gerona/glt145

6. Lv X, Li W, Ma Y, Chen H, Zeng Y, Yu X, et al. Cognitive decline and mortality among community-dwelling chinese older people. BMC Med [Internet]. 2019 [cited 2023 Jan 12];17(1):63. Available from: https://doi.org/10.1186/s12916-019-1295-8

7. Loyd C, Markland AD, Zhang Y, Fowler M, Harper S, Wright NC, et al. Prevalence of hospital-associated disability in older adults: A meta-analysis. J Am Med Dir Assoc [Internet]. 2020 [cited 2022 Dec 2];21(4):455-61.e5. Available from: https://doi.org/10.1016/j.jamda.2019.09.015

8. Dharmarajan K, Han L, Gahbauer EA, Leo-Summers LS, Gill TM. Disability and recovery after hospitalization for medical illness among community-living older persons: A Prospective cohort study. J Am Geriatr Soc [Internet]. 2020 [cited 2022 Nov 14];68(3):486-95. Available from: https://doi.org/10.1111/jgs.16350

9. Yang Y, Xiao M, Leng L, Jiang S, Feng L, Pan G, et al. A systematic review and meta analysis of the prevalence and correlation of mild cognitive impairment in Sarcopenia. J Cachexia Sarcopenia Muscle [Internet]. 2023 [cited 2023 Feb 18];14(1):45-56. Available from: https://doi.org/10.1002/jcsm.13143

10. Huang CH, Hsu CC, Yu PC, Peng LN, Lin MH, Chen LK. Hospitalization-associated muscle weakness and functional outcomes among oldest old patients: A hospital-based cohort study. Exp Gerontol [Internet]. 2021 [cited 2023 Feb 19];150:111353. Available from: https://doi.org/10.1016/j.exger.2021.111353

11. Bordin D, Cabral LPA, Fadel CB, Santos CB dos, Garden CRB. Factors associated with the hospitalization of the elderly: A national study. Rev Bras Geriatr Gerontol [Internet]. 2018 [cited 2022 Jul 16];21(4):439-46. Available from: https://doi.org/10.1590/1981-22562018021.180059

12. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: Guidelines for reporting observational studies. J Clin Epidemiol [Internet]. 2008 [cited 2023 May 1];61(4):344-9. Available from: https://doi.org/10.1016/j.jclinepi.2007.11.008

13. Herrera E, Caramelli P, Silvia Barreiros Silveira A, Nitrini R. Epidemiologic survey of dementia in a community-dwelling Brazilian population. Alzheimer Dis Assoc Disord [Internet]. 2002 [cited 2022 Oct 12];16(2):103-8. Available from: https://doi.org/10.1097/01.WAD.0000020202.50697

14. Gilardi F, Scarcella P, Proietti MG, Capobianco G, Rocco G, Capanna A, et al. Frailty as a predictor of mortality and hospital services use in older adults: A cluster analysis in a cohort study. Eur J Public Health [Internet]. 2018 [cited 2022 Nov 15];28(5):842-6. Available from: https://doi.org/10.1093/eurpub/cky006

15. World Health Organization. WHO global report on falls prevention in older age [Internet]. World Health Organization; 2008 [cited 2022 Nov 15]. 47 p. Available from: https://www.who.int/publications/i/item/9789241563536

16. Cruz-Jentoft AJ, Bahat G, Bauer J, Boirie Y, Bruyere O, Cederholm T, et al. Sarcopenia: Revised European consensus on definition and diagnosis. Age Ageing [Internet]. 2019 [cited 2023 Feb 20];48(1):16-31. Available from: https://doi.org/10.1093/ageing/afy169

17. Alencar MA, Dias JD, Figueiredo LC, Dias RC. Handgrip strength in elderly with dementia: study of reliability. Brazilian J Phys Ther [Internet]. 2012 [cited 2023 Mar 21];16(6):510-4. Available from: https://doi.org/10.1590/S1413-35552012005000059

18. Ayan C, Cancela JM, Gutiérrez A, Prieto I. Influence of the cognitive impairment level on the performance of the Timed “Up & Go” Test (TUG) in elderly institutionalized people. Arch Gerontol Geriatr [Internet]. 2013 [cited 2023 Jul 26];56(1):44-9. Available from: https://doi.org/10.1016/j.archger.2012.06.002

19. Luo Y, Zhang Z, Gu D. Education and mortality among older adults in China. Soc Sci Med [Internet]. 2015 [cited 2023 Jun 11];127:134-42. Available from: https://doi.org/10.1016/j.socscimed.2014.09.039

20. de Souza AG, Bortolotto CC, Bertoldi AD, Tomasi E, Demarco FF, Gonzalez MC, et al. All-cause mortality over a three-year period among community-dwelling older adults in Southern Brazil. Rev Bras Epidemiol [Internet]. 2021 [cited 2023 Jun 17];24:E210015. Available from: https://doi.org/10.1590/1980-549720210015

21. Falvey JR, Burke RE, Levy CR, Gustavson AM, Price L, Stevens-Lapsley JE, et al. Impaired physical performance predicts hospitalization risk for participants in the program of all-inclusive care for the elderly. Phys Ther [Internet]. 2018 [cited 2023 Feb 13];99(1):28-36. Available from: https://doi.org/10.1093/ptj/pzy127

22. Schonberg MA, Davis RB, McCarthy EP, Marcantonio ER. Index to predict 5-year mortality of community-dwelling adults aged 65 and older using data from the national health interview survey. J Gen Intern Med [Internet]. 2009 [cited 2023 Feb 11];24(10):1115-22. Available from: https://doi.org/10.1007/s11606-009-1073-y

23. Phelan EA, Soo Borson M, Grothaus L, Steven Balch M, Eric Larson MB. Association of incident dementia with hospitalizations. JAMA Netw Open [Internet]. 2012 [cited 2023 Mar 18];307(2):165-72. Available from: https://doi.org/10.1001/jama.2011.1964

24. Chen LK, Chen YM, Hwang SJ, Peng LN, Lin MH, Lee WJ, et al. Effectiveness of community hospital-based post-acute care on functional recovery and 12-month mortality in older patients: A prospective cohort study. Ann Med [Internet]. 2010 [cited 2023 Feb 25];42(8):630-6. Available from: https://doi.org/10.3109/07853890.2010.521763

25. Zhang X, Zhang W, Wang C, Tao W, Dou Q, Yang Y. Sarcopenia as a predictor of hospitalization among older people: A systematic review and meta-analysis. BMC Geriatr [Internet]. 2018 [cited 2023 Mar 22];18(1):188. Available from: https://doi.org/10.1186/s12877-018-0878-0

26. Liu P, Hao Q, Hai S, Wang H, Cao L, Dong B. Sarcopenia as a predictor of all-cause mortality among community-dwelling older people: A systematic review and meta-analysis. Maturitas [Internet]. 2017 [cited 2023 Feb 21];103(1):16-22. Available from: https://doi.org/10.1016/j.maturitas.2017.04.007

27. Field A. Descobrindo a Estatística Usando o SPSS. 2nd ed. Porto Alegre, RS(BR): Artmed; 2009.

28. Ishii S, Tanaka T, Shibasaki K, Ouchi Y, Kikutani T, Higashiguchi T, et al. Development of a simple screening test for sarcopenia in older adults. Geriatr Gerontol Int [Internet]. 2014 [cited 2023 Jun 7];14 Suppl 1:93-101. Available from: https://doi.org/10.1111/ggi.12197

29. Becker C, Zumbrunn S, Beck K, Vincent A, Loretz N, Muller J, et al. Interventions to improve communication at hospital discharge and rates of readmission: A systematic review and meta-analysis. JAMA Netw Open [Internet]. 2021 [cited 2023 Feb 26];4(8):e2119346. Available from: https://doi.org/10.1001/jamanetworkopen.2021.19346

NOTES

ORIGIN OF THE ARTICLE

Article extracted from the – "*Fatores preditores de hospitalização e óbito em idosos com comprometimento cognitivo acolhidos por serviço de atenção especializada nos Sistema Público de Saúde*", presented to the Graduate Program in Rehabilitation Sciences, *Universidade de Brasília*, in 2023.

CONTRIBUTION OF AUTHORITY

Study design: Barros RS, Garcia PA.
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Data analysis and interpretation: Barros RS, Teixeira GTM, Garcia PA.
Discussion of results: Barros RS, Teixeira GTM, Garcia PA.
Writing and/or critical review of content: Barros RS, Teixeira GTM, Pinto JM, Mendes FAS, Garcia PA.
Review and final approval of the final version: Barros RS, Teixeira GTM, Pinto JM, Sampaio RX, Mendes FAS, Garcia PA.

FUNDING INFORMATION

This study was carried out with the financial support of the *Fundação de Apoio à Pesquisa do Distrito Federal* (Process/2022-77 00193.00001759) and the *Fundação Universidade de Brasília* through the Scientific Initiation Program at the *Universidade de Brasília* (ProIC/UnB).

APPROVAL OF RESEARCH ETHICS COMMITTEE

Approved by the Ethics Committee in Research FAPDF Health Department of the Federal District, Opinion 5,530,841. Approved by the Research Ethics Committee/*Universidade de Brasília*/*Faculdade de Ceilândia*/, Opinion 5,390,784. *Certificado de Apresentação para Apreciação Ética* 57135322.2.3001.5553.

CONFLICT OF INTEREST

There is no conflict of interest.

TRANSLATED BY

Leticia Belasco.

HISTORICAL

Received: July 06, 2023.
Approved: September 14, 2023.

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