

Decreased gait speed and health outcomes in older adults: Rede FIBRA's data

Declínio da velocidade da marcha e desfechos de saúde em idosos: dados da Rede Fibra

Disminución de la velocidad de la marcha y resultados en la salud de los ancianos: datos de la Red Fibra

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ABSTRACT | Gait speed (GS) can predict adverse health outcomes. However, an understanding of its associated factors is still limited and with some controversy. The objective of this study was to identify adverse health outcomes related to the decline in gait speed in community-dwelling older adults. This is a cross-sectional study that evaluated records of chronic diseases and hospitalization in the last year, polypharmacy, and gait speed. Logistic regression analysis was used to estimate the effects of each independent variable on the chance of older adults presenting a decline in gait speed (GS<0.8 m/s) ($\alpha=5\%$). In total, 5,501 older adults participated. Brazilian older adults with heart diseases (OR=2.06; 1.67-2.54 CI), respiratory diseases (OR=3.25; 2.02-5.29 CI), rheumatic (OR=2.16; 1.79-2.52 CI) and/or depression diseases (OR=2.51; 2.10-3.14 CI); hospitalized in the last year (OR=1.51; 1.21-1.85 CI) and under polypharmacy (OR=2.14; 1.80-2.54 CI) were associated with lower gait speed. Thus, the results showed that those with gait speed lower than 0.8 m/s are at higher risk of some adverse health events. Therefore, it is suggested that gait speed should not be neglected in the evaluation in community-dwelling older adults, including basic health care.

Keywords | Aged; Gait; Chronic Diseases.

RESUMO | A velocidade da marcha (VM) tem sido considerada um marcador de saúde em idosos capaz de prever desfechos adversos de saúde, mas a compreensão

de fatores associados a ela ainda é limitada e controversa. O objetivo deste trabalho é identificar desfechos adversos de saúde relacionados ao declínio da velocidade de marcha em idosos comunitários. Trata-se de estudo transversal e multicêntrico, que avaliou o autorrelato de doenças crônicas e de hospitalização no último ano, polifarmácia e velocidade de marcha. Utilizou-se análise de regressão logística para estimar os efeitos de cada variável independente na chance de os idosos apresentarem declínio na velocidade de marcha inferior (VM<0,8m/s) ($\alpha=0,05$). Participaram da pesquisa 5.501 idosos. A menor velocidade da marcha mostrou-se associada a portadores de doenças cardíacas (OR=2,06; IC: 1,67-2,54), respiratórias (OR=3,25; IC: 2,02-5,29), reumáticas (OR=2,16; IC: 1,79-2,52) e/ou depressão (OR=2,51; IC: 2,10-3,14), hospitalizados no último ano (OR=1,51; IC: 1,21-1,85) e polifarmácia (OR=2,14; IC: 1,80-2,54). Assim, os resultados indicaram que idosos com velocidade de marcha menor que 0,8m/s apresentam maior risco de eventos adversos de saúde. Dessa forma, sugere-se que a velocidade de marcha não seja negligenciada na avaliação de idosos comunitários, inclusive na atenção básica.

Descritores | Idoso; Marcha; Doenças Crônicas.

RESUMEN | La velocidad de la marcha (VM) se ha considerado un marcador de salud en los ancianos capaz

A multicenter study conducted in 17 Brazilian cities by researchers from Universidade Federal de Minas Gerais, Universidade de São Paulo, Universidade de Campinas and Universidade Estadual Rio de Janeiro.

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de predecir resultados adversos en la salud, pero la comprensión de sus factores asociados todavía es limitada y controvertida. El presente estudio tiene como objetivo identificar los resultados adversos para la salud relacionados con la disminución de la velocidad de la marcha en los ancianos comunitarios. Se trata de un estudio transversal y multicéntrico, el que evaluó el autoinforme de enfermedades crónicas y de la hospitalización en el último año, la polifarmacia y la velocidad de la marcha. Se utilizó el análisis de regresión logística para estimar los efectos de cada variable independiente sobre la posibilidad de que los ancianos presenten una disminución más baja en la velocidad de la marcha ($VM < 0,8$ m/s) ($\alpha = 0,05$). Participaron

en el estudio 5.501 ancianos. La velocidad de marcha más baja estuvo asociada a portadores de enfermedades cardíacas (OR=2,06; IC: 1,67-2,54), respiratorias (OR=3,25; IC: 2,02-5,29), reumáticas (OR=2,16; IC: 1,79-2,52) y/o depresión (OR=2,51; IC: 2,10-3,14), hospitalizados en el último año (OR=1,51; IC: 1,21-1,85) y polifarmacia (OR=2,14; IC: 1,80-2,54). De esta manera, los resultados indicaron que los ancianos con velocidades de marcha por debajo de 0,8m/s presentan un mayor riesgo de eventos adversos para la salud. Por lo tanto, se sugiere que la velocidad de la marcha no debe ser descuidada en la evaluación de ancianos comunitarios, incluso en la atención primaria.

Palabras clave | Anciano; Marcha; Enfermedades Crónicas.

INTRODUCTION

Physical function decreases with age and predicts higher rates of disability, institutionalization and death. Thus, maintaining the functional capacity of older adults is crucial to extend an independent life^{1,2}. The accumulation of diseases negatively influences functional capacity and quality of life^{3,4}. In the context of functional capacity, gait consists of a dynamic activity that is fundamental for the accomplishment of the activities of daily living and necessary for the independence of individuals⁵. However, gait tends to become slower with aging, suggesting that everyone selects the speed most compatible with their functional abilities. Thus, gait slowness arises due to the physiological process of aging, often associated with already established clinical conditions or those that have not yet manifested, remaining silent in the clinical setting of older adults⁶.

Given this context, usual gait speed has been considered a predictor of functional decline, hospitalization, hospital discharge, caregiver need and mortality⁷. Likewise, it has been associated with a higher incidence of fractures, institutionalization and changes in quality of life, factors that increase health costs^{8,9}. Studies have observed that a 0.1 m/s reduction in gait speed increases the risk of death by 12%^{7,10}, and that older individuals with decreased gait speed are 2.5 times more likely to present adverse health outcomes¹¹. Thus, gait speed has been considered as a “sixth vital sign” and a functional health marker⁶ due to its importance as an indicator of health and function, as well as its easy evaluation and interpretation.

The International Academy on Nutrition and Aging (IANA) identified several cut-off points for gait speed, ranging from 0.15 m/s to 1.3 m/s, related to adverse health outcomes such as falls, heart and lung disease, frailty, sarcopenia, hospitalization, institutionalization and death⁸. Studenski et al.⁷ used the 0.8 m/s cut-off point and demonstrated that older people with faster gait speed had longer life expectancy. Moreover, the presence of chronic diseases, polypharmacy, low social and educational conditions have also been related to declining gait speed, mobility and worse health prognosis^{3,5,8,11}. However, there is still limited understanding of its associated factors and their implications in various populations. A recent study demonstrated the influence of economic and social factors and life expectancy at birth with gait speed changes, considering the domains of the Human Development Index (HDI)¹².

This study sought to determine the risk of adverse health outcomes (heart, respiratory and rheumatic diseases, systemic arterial hypertension, diabetes mellitus, cancer, osteoporosis, depression, hospitalization and polypharmacy) to declining gait speed of community-dwelling older adults .

METHODOLOGY

This is a cross-sectional, multicenter study that is part of the Frailty in Brazilian Older People Network (Rede Fibra) project. This multidisciplinary network evaluated older adults living in different cities of the five Brazilian regions, selected using a randomization

process in census-designated places. The sample selection and the inclusion/exclusion criteria have already been published in previous studies^{13,14}. Thus, community-dwelling individuals, older than 65 years, who agreed to participate in the interview and physical tests and signed the Informed Consent Form were invited to participate in the study¹³. Data were collected at participants' homes by trained researchers in previously scheduled interviews. This study followed the guidelines for strengthening the reporting of observational studies in epidemiology (Strobe).

Exclusion criteria were: having severe sequelae caused by stroke and/or neurological diseases that prevented the tests; use of a wheelchair or being bedridden; and presenting cognitive deficit indicated by a score of less than 17 in the mini-mental state exam¹⁵. To meet the objectives of this study, Rede Fibra's national bank was analyzed, containing information collected in all participating cities.

The dependent variable was the usual gait speed (m/s), evaluated at 4.6m, plus 2m for acceleration and 2m for deceleration. Participants wore their usual footwear. Participants were instructed to walk at their normal speed. Travel time was timed from the voice command "Ready? Go...". Three measurements were taken, and the mean was used for the analyses. Gait speed was used as categorical variable, using the 0.8m/s cut-off point, indicated as the most sensitive value to identify the influence of adverse health outcomes^{7,8,16-18}. The sample was then categorized into a group composed of participants with gait speed below 0.8m/s and another group formed by participants with gait speed equal to or greater than 0.8 m/s.

The independent variables were evaluated with a multidimensional survey standardized by Rede Fibra, with interviews and self-reported information. This methodology was used in the studies of Rede Fibra^{13,14}. The following variables were selected for this study: self-reported presence of chronic diseases diagnosed by a physician (heart, respiratory and rheumatic diseases, systemic arterial hypertension, diabetes mellitus, cancer, osteoporosis and depression) ("Have you ever been diagnosed with..."); self report of hospitalization in the last 12 months ("Have you been hospitalized in the last 12 months?") and polypharmacy (defined as the use of four or more regular medicines during the last three months, either by consulting medicine packages and/or prescription).

Statistical analysis

The study was based on a probabilistic sample of community-dwelling older adults, stratified according to the older adult population density, based on data from the 2000 census conducted by the Brazilian Institute of Geography and Statistics (IBGE). The sample size required for a population proportion of 50% of a given characteristic under study (value in which the sample size obtained was the maximum possible ($p=0.50$, $q=0.50$)) was estimated to determine the sample of each city, according to their older adult population. The significance level was set at 5% ($\alpha=0.05$, $Z=1.96$). The sample error ranged from 3% to 5%. Based on these estimates, the sample size of cities with more than one million inhabitants was set at 601 older adults, considering 4% error. For cities with less than one million inhabitants, the sample value was set at 385 older adults, considering 5% error.

The sample description was given by mean and standard deviation for continuous variables, and percentage for categorical variables. Data distribution analysis was performed using the Kolmogorov-Smirnov test. Differences between groups were assessed by Kruskal-Wallis and chi-square tests. Variables with p-values greater than 0.10 in bivariate analyses were excluded from multivariate analyses. A binary logistic stepwise forward regression model was traced with the gait speed dependent variable (categorized as less than 0.8m/s or greater than 0.8m/s) and as independent variables (self-reported presence of heart disease, respiratory and rheumatic; systemic arterial hypertension; diabetes mellitus; cancer, osteoporosis and depression, diagnosed by a doctor; hospitalization and polypharmacy). Thus, this analysis sought to explore the association of risk of independent variables with the dependent variable (gait speed lower than 0.8m/s when compared to older individuals with gait speed equal to or greater than 0.8m/s). The odds of each independent variable to be associated with gait speed were analyzed by odds ratio (OR) and 95% confidence interval (CI). As they were not the objective of this study, sociodemographic variables were excluded from the model. All analyses were performed in the SPSS 17.0 statistical program and the significance level considered was 5%.

RESULTS

In total, 5501 older adults all over Brazil participated in this study (Rede Fibra). Most were women (66.20%) and the mean age was 73.01±6.17 years. The overall mean gait speed was 1.00±0.69 m/s, and 34.26% of the older adults had GS<0.8 m/s. Thus, the older adults classified in this group – GS<0.8m/s – presented greater chronic diseases rates. Univariate analyses showed statistically significant differences among the older adults with GS<0.8 m/s and GS≥0.8 m/s when compared to all independent variables (p<0.05), except for those with cancer reports. Table 1 shows these results and other sample characteristics.

Variables with p-value greater than 0.10 were excluded from the model of the multivariate analyses. Thus, the model that best explained gait speed identified that older adults reported receiving medical diagnosis of heart disease, respiratory diseases, rheumatic diseases and/or depression. They also reported having been hospitalized in the last 12 months and using four or more medicines regularly in the last three months. They showed a greater chance of having GS<0.8m/s. In this case, with these conditions, Table 2 showed at least a 1.51 greater chance of older adults presenting gait speed decline. Self-report of systemic arterial hypertension, diabetes mellitus, cancer and osteoporosis, even if initially different, did not remain in the final model.

Table 1. Mean, standard deviation and frequency of distribution of independent variables, comparing older adults with GS<0.8 m/s and those with GS≥0.8 m/s and p-value

Characteristics	Total sample (N=5501)	Older adults GS<0.8 m/s (N=1885)	Older adults GS≥0.8 m / s (N=3616)	p-value
Age (Yrs), Mean ± SD	73.01±6.17	75.11±6.77	72.18±5.65	<0.01*
Sex				<0.01*
Men, n (%)	1862 (33.81)	476 (25.30)	1386 (38.30)	
Women, n (%)	3639 (66.20)	1409 (74.70)	2230 (61.70)	
Heart diseases, n (%)	1005 (18.30)	590 (31.30)	415 (11.50)	<0.01*
Respiratory diseases, n (%)	435 (7.90)	385 (20.40)	50 (1.40)	<0.01*
Rheumatic diseases, n (%)	1738 (31.60)	852 (45.20)	886 (24.50)	<0.01*
Systemic Arterial Hypertension, n (%)	3173 (57.70)	1127 (59.80)	2046 (56.60)	0.02*
Diabetes mellitus, n (%)	1079 (19.60)	665 (35.30)	414 (11.50)	<0.01*
Cancer, n (%)	260 (4.70)	79 (4.20)	181 (5.00)	0.09
Osteoporosis, n (%)	1183 (21.50)	457 (24.30)	726 (20.10)	<0.01*
Depression, n (%)	908 (16.50)	352 (18.70)	556 (15.40)	0.02*
Hospital admission in the last year, n (%)	893 (16.20)	437 (23.20)	456 (12.60)	<0.01*
Polypharmacy, n (%)	1719 (31.24)	852 (45.20)	867 (24.00)	<0.01*
SG (m/s), mean ± SD	1.0±0.69	0.59±0.15	1.06±0.19	<0.01*

SD: standard deviation; GS: normal gait speed; * significant difference.

Table 2. Odds ratio, confidence interval and statistical significance of the factors associated with GS lower than 0.8 m/s in the older adult sample of Rede Fibra

VARIABLES	OR	95%CI	p-value
Heart diseases	2.06	(1.67 - 2.54)	<0.01*
Respiratory diseases	3.25	(2.02 - 5.29)	0.01*
Rheumatic diseases	2.16	(1.79 - 2.52)	<0.01*
Depression	2.51	(2.10 - 3.14)	<0.01*
Hospitalization	1.51	(1.21 - 1.85)	<0.01*
Polypharmacy	2.14	(1.80 - 2.54)	<0.01*

GS: normal gait speed; 95%CI: 95% confidence interval; OR: odds ratio; * significant difference.

DISCUSSION

This study sought to analyze the relationship between some adverse health outcomes (heart, respiratory and rheumatic diseases, systemic arterial hypertension, diabetes mellitus, cancer, osteoporosis, depression, hospitalization and medication) with the gait speed decline in older adults. The results showed that those with GS<0.8m/s had a greater history of hospitalization, some clinical conditions and greater use of medicines. These results confirm the Brazilian and international literature, and point to energy reserve reduction and homeostasis loss in the aging process¹⁻⁶.

Older adults with a diagnosis of heart disease such as angina, myocardial infarction or heart failure were 2.06 times more likely to have $GS < 0.8$ m/s. Chronic diseases, in general, cause muscle mass reduction as a consequence of pathophysiological processes that increase cell catabolism¹⁹, which could be one of the reasons for this strong association. Similarly, the literature indicates that respiratory symptoms, reduced mobility and heart disease are present in old age and associated with important health outcomes²⁰. Our results also showed those with bronchitis and/or emphysema were 3.25 times more likely to have $GS < 0.8$ m/s. Given this context, previous studies have confirmed our result, identifying an association between reduced gait speed and increased lung disease severity and a strong negative correlation between gait speed and dyspnea severity²¹. These results can be justified by the restriction and decrease of aerobic capacity of older adults with such conditions.

Rheumatic diseases are also associated with functional decline and slow gait in older adults²². In this case, gait speed reduction can be interpreted as a consequence of muscle weakness in the lower limbs and of proprioceptive changes that compromise the postural balance in individuals with these diseases. Moreover, the tendency for cadence, and step and stride size decrease is evidenced as a strategy to reduce compressive forces in lower limb joints and, consequently, relieve the pain caused by joint and rheumatic diseases^{22,23}. These results corroborate with studies on specific gait parameters^{12,22,23}.

Older adults with greater number of depressive symptoms demonstrated a 2.51 times greater chance of walking in $GS < 0.8$ m/s. This result confirmed the literature that points out that depression and gait slowness, and other chronic-degenerative conditions previously discussed, occur frequently and simultaneously in old age. These conditions are associated with disabilities, cognitive decline, environmental and psychosocial factors that may influence one's health²⁴⁻²⁶. Our results do not allow to infer about causality; however, they have relevance when demonstrating the association between these conditions, confirming that GS can be considered a functional health marker.

Elderly people with a higher number of chronic degenerative conditions tend to use a larger number of medicines, which may also impact on overall and functional health²⁷. This assumption was also confirmed in this study, which pointed out that those who regularly used four or more medicines had 2.14 higher chances of having $GS < 0.8$ m / s. Peron et al.²⁸ demonstrated that the

use of drugs such as benzodiazepines, anticholinergics, antidepressants and antihypertensives were associated with worse functional status. In our study, the specific type of drug used by the elderly were not analyzed but only the number of medicines in use, which can be considered a limitation of this study and should be explored in future studies.

Older adults who reported being hospitalized in the last 12 months had a 1.51 times greater chance of walking at $GS < 0.8$ m/s. After discharge, patients often experience negative short-, medium- and long-term consequences such as functional decline, disability, new hospitalization, institutionalization and death²⁶. Recent studies have shown functional capacity reduction during hospitalization, which cannot be recovered after hospital discharge²⁹, reaching 19% of functional capacity with limitations on basic activities of daily living and 40% on instrumental activities of daily living after hospitalization^{29,30}. In this case, the number of hospitalizations and their reasons were not analyzed, which may also be a limitation in the interpretation of this data. Likewise, reporting the time of diagnosis of diseases in future studies is also important, as a greater restriction of mobility and functional capacity may be associated with disease aggravation and chronification.

The significant difference of age observed between the groups is important to be discussed. Although we acknowledge the evidence of sociodemographic variables, this study did not seek to explore them¹². The age presents multicollinearity, mainly when compared with heart, respiratory, rheumatic and hospitalized diseases, not justifying its analysis in the model. Given this context, it is known that gait and its spatiotemporal parameters tend to change over the years and with some diseases^{5,6,31}. Some authors have demonstrated a physiological loss, including in gait speed, inherent to the aging process^{12,31}. Thus, given the multicollinearity of age with the independent variables analyzed, we suggest future studies with longitudinal and mediation analyses to verify the magnitude of age influence.

Finally, our data are relevant because this is a multicenter study, ensuring the participation of older adults in the five regions of Brazil, and the possibility of knowing the characteristics of the studied population. As the literature points out, gait speed may be influenced by contextual, socioeconomic and clinical factors, and access to health services¹². In the case of Brazil, which presents continental dimensions and great regional diversity, this study is the first step to better understand the gait behavior of community-dwelling older adults, which can subsidize

health policies for this population and others with similar characteristics. Thus, from the clinical applicability point of view, the results found in this study suggest that gait speed can be considered a health marker for community-dwelling older adults. This study thus suggests the use of this measure in clinical practice and greater attention to those with a slower gait.

CONCLUSION

The results of this study showed that the older adults with gait speed slower than 0.8m/s were at higher risk of adverse health events (heart, respiratory and rheumatic diseases, systemic arterial hypertension, diabetes mellitus, cancer, osteoporosis hospitalization and polypharmacy). Thus, gait speed should not be neglected in the evaluation of older adults, even in basic care.

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