

ORIGINAL ARTICLE



Mortality trend from falls in Brazilian older adults from 2000 to 2019

Tendência de mortalidade por quedas em idosos, no Brasil, no período de 2000–2019

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ABSTRACT

Objective: To analyze the trend of mortality from falls among older adults in Brazil from 2000 to 2019. **Methods:** This is an epidemiological, analytical study with an ecological time-series design. A retrospective analysis was performed using secondary health data extracted from the Brazilian Mortality Information System in the specific period. Standardized rates of general and sex- and age-specific mortality were calculated. To observe the mortality trend, the Prais-Winsten model and the Annual Increase Rate (AIR) were used. **Results:** We identified 135,209 deaths resulting from falls in older adults in the period from 2000 to 2019. Mortality from falls in general, during the study period, had an upward trend ($\beta=0.023$; $p<0.001$; AIR=5.45%). We observed that both men ($\beta=0.022$; $p<0.001$; AIR=5.19%) and women ($\beta=0.024$; $p<0.001$; AIR=5.72%) had an upward trend. Regarding age group, the results also pointed to an upward mortality trend in all age strata, although higher in older people aged ≥ 80 years ($\beta=0.027$; $p<0.001$; AIR=6.38%). **Conclusion:** There was an upward trend in mortality rates in Brazil during the time series studied. These findings suggest the importance of defining a line of care for this age group, focusing on promoting health in older adults and preventing the risk of falls, aiming at a reduction in the number of deaths from this cause and favoring the quality of life of this population.

Keywords: Epidemiology. Temporal distribution. Mortality. Accidental falls. Aged.

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INTRODUCTION

Population aging is a worldwide phenomenon^{1,2}, and the Brazilian population of older adults reached the mark of 31.3 million in 2021. The expectation for the year 2050 is that 30% of the country's population will be of older people³. When compared with the global scenario, the expansion of the older adult population in Brazil stands out for having happened in an intense and accelerated way^{3,4}.

The inversion of the population pyramid is a major challenge for public policies, which must take into account the rights and specific healthcare needs of this population group⁵, which is susceptible to age-related diseases and events such as falls⁶.

It should be noted that falls can be defined as unexpected events in which people hit the ground, floor, or a lower level⁷. Corroborating this concept, Vieira et al.⁸ state that falls are characterized by the lack of ability to correct the displacement of the body during its movement in space.

Falls are common in the older adult population, have a multifactorial etiology, and mainly result from sensorimotor deficits, which increase with advancing age^{6,9}. However, they are also related to extrinsic factors (environmental risks) such as poor lighting, slippery floors, loose or folded rugs, poorly maintained public roads with holes or irregularities, polypharmacy, and inappropriate orthotics¹⁰⁻¹².

It is noteworthy that accidental falls can victimize people regardless of age, sex, and socioeconomic status; nevertheless, the highest prevalence of death from this cause occurs in older adults^{13,14}. Thus, discussions on this situation become even more relevant, considering the increase in life expectancy and, consequently, the greater proportion of individuals aged 60 years or older¹⁵.

Deaths from falls are included in the external causes of mortality, occupying a prominent position in statistics in most countries, including Brazil¹⁶⁻¹⁸. The Global Burden of Disease, Injuries, and Risk Factors Report (GBD), published in 2017, addresses the epidemiology of falls and has largely focused on older populations, as it is in this age group that deaths from this reason are concentrated¹⁹.

Falls in older people represent a public health concern, considering the frequency with which they occur and the consequences for the person, their family, and the health system^{14,15,18}. A decline in the quality of life of older adults has been observed as a result from falls — which particularly and mostly affects those with lower income, compromising several aspects of their lives such as functional capacity, physical aspects, pain, emotional factors, and mental health²⁰. In addition, the direct and indirect financial costs of falls in older adults must be considered. Directly concerning the health system, an increase in the number of hospitalizations and in their total cost has been observed over the last decade²¹.

Indirectly, falls are critical for the family, considering the loss of productivity of caregivers, who are often family members²². Death is the most serious consequence that can result from falls in this population.

Although the health of older people has been a priority in the Management Pact of the Brazilian Unified Health System (SUS) since 2006^{23,24}, the adopted indicators have been insufficient to verify the impact of policies on this population. The fact that they are not based on the integrality of care is also noteworthy. In this regard, it is also worth considering the need for intersectoral articulation, especially in relation to health promotion initiatives, which cannot do without this articulation^{25,26}.

In this context, although data on the upward trend in the mortality rate from falls in Brazilian older adults^{14,17,27,28} are available in the literature, the time series are short^{14,27} and/or restricted to specific regions of the country^{27,28}. Thus, studies that update this information are essential for monitoring public health policies already implemented and helping health managers in decision-making, planning, and the formulation of new policies and programs to avoid the occurrence of deaths from preventable causes such as falls. Therefore, we aimed to analyze the trend of mortality from falls among Brazilian older adults from 2000 to 2019.

METHODS

This is an epidemiological, analytical study with an ecological time-series design. A retrospective analysis was carried out with secondary health data, focusing on the temporal analysis of data on mortality in older adults who were victims of falls in Brazil, in a historical series from 2000 to 2019.

The data, extracted from the Brazilian Mortality Information System (*Sistema de Informação de Mortalidade – SIM*), coordinated by the Department of Informatics of the SUS (DATASUS), are available from <http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sim/cnv/obt10uf.def> and refer to the study period, collected by death, per occurrence²⁹.

Deaths with codes from W00 to W19, belonging to the category “falls,” were analyzed, which had been classified according to the criteria of the International Statistical Classification of Diseases and Related Health Problems (Tenth Revision) — ICD-10³⁰. Data were analyzed according to the main variables: sex (man/woman); age group (60 to 64 years old, 65 to 69 years old, 70 to 74 years old, 75 to 79 years old, and ≥80 years old), ethnicity/skin color (white, black, Asian, mixed-race, Indigenous, and ignored), level of education (illiterate, one to three years of formal education, four to seven years of formal education, eight to 11 years of formal education, ≥12 years of formal education, and ignored), and marital status (single, married, widowed, legally separated, others, and ignored). The following inclusion criteria were considered: having a SIM record and age ≥60 years. Records that did not include

age and sex were excluded. Between the years 2000 and 2019, 135,221 deaths were recorded among older adults due to falls in Brazil; however, to meet the proposed exclusion criteria, 12 were excluded, totaling 135,209 deaths for analysis.

In establishing the mortality rate, population data obtained from estimates from the Brazilian Institute of Geography and Statistics (IBGE)³ were used, available from: <https://www.ibge.gov.br/estatisticas/sociais/populacao/9109-projecao-da-populacao.html?edicao=9116&t=resultados>.

The general and specific mortality rates were estimated by dividing the number of deaths in the study population (total deaths, deaths per sex, deaths per age group) by the corresponding population in the period and group (sex and age group) estimated by IBGE³, multiplied by 100 thousand inhabitants. In order to eliminate age differences in the studied population, the mortality rate was standardized by age. For developing the method, the precepts of Curtin and Klein³¹, from the National Center for Health Statistics (NCHS), were followed. The direct methodology was adopted, with the world population as the standard, according to the World Health Organization (2000–2025)³². The calculation was performed using deaths stratified by sex and age group.

For data tabulation, the Microsoft Excel program was used, in which mortality rates were calculated. Statistical analyses to assess the time trend and the Annual Increase Rate (AIR) were performed in the Stata statistical package, version 13.0.

To observe the mortality trend, the Prais-Winsten model, a generalized linear regression analysis technique, was adopted³³. The standardized mortality rates were considered as the dependent variable (Y), and the years in which the deaths occurred, sex, and age group were considered as the independent variables (X). To apply the model, initially, the log transformation of the variables of interest was performed, followed by the application of the Prais-Winsten autoregressive model, by which the β value of the general and standardized mortality rates was obtained, referring to the slope of the line. Based on the analysis of the rate of change, a trend is considered upward when the rate of change is positive; downward, when the rate of change is negative; and stationary, when there is no significant difference between its value and zero. The level of significance was given by comparing the p-value and the value given by the standard normal curve (t), with a confidence interval of 95%. A trend was considered significant when the estimated model obtained $p < 0.05$.

For the AIR, the following formula was considered:

$$\text{AIR} = (-1 + 10^\beta) * 100$$

Where the β value corresponds to the slope coefficient of the line formed in the regression.

To estimate the confidence interval (CI) of the study measures, the following formula was used:

$$95\% \text{CI} = (-1 + 10^{(\beta \pm t * SE)}) * 100$$

Where t is the value at which the Student's t distribution has 19 degrees of freedom at a two-tailed 95%CI; and SE is the standard error of the β estimate, provided by the regression analysis.

For all statistical tests performed, a significance level of 5% was adopted. Thus, $p \leq 0.05$ values were deemed significant.

The research project was submitted for consideration by the Ethics Committee in Research Involving Human Beings of Universidade Federal dos Vales do Jequitinhonha e Mucuri (UFVJM), having been approved under Opinion No. 4.730.193 (Certificate of Presentation for Ethical Consideration — CAAE 44440921.0.3001.5108).

RESULTS

Between 2000 and 2019, 135,209 deaths from falls in older adults were recorded, of which 51.41% occurred in women. Deaths from this cause are concentrated in the age group of ≥ 80 years (56.12%). Regarding sociodemographic characteristics, we observed that 65.10% of the study population were white and 60.87% had a maximum level of education of seven years of formal study. Approximately 40.00% of the population consisted of widowed people (Table 1).

The results demonstrate an increase in the standardized rate of general mortality from falls among older adults in the period from 2000 to 2019, with the highest rate observed in 2017 (41.99/100 thousand) (Table 2). As for sex, we observed that the highest standardized mortality rate for men (48.35/100 thousand) was recorded in 2018, and for women (36.81/100 thousand), in 2017 (Table 2, Figure 1).

When stratifying the study population by age group, the results suggest an increase in the standardized mortality rate from falls with advancing age. In 2000, the first in the studied series, we identified that the standardized mortality rates from falls in older adults were 1.52/100 thousand (60–64 years old), 1.74/100 thousand (65–69 years old), 1, 87/100 thousand (70–74 years old), 2.15/100 thousand (75–79 years old), and 6.89/100 thousand (≥ 80 years old). In 2019, the last year in the series, these standardized rates were respectively: 3.02/100 thousand; 3.57/100 thousand; 4.58/100 thousand; 6.15/100 thousand; and 22.15/100 thousand. The highest standardized mortality rates from falls in the study period were recorded among older people aged ≥ 80 years. In 2000, the rate was 6.89/100 thousand; and in 2019, 22.15/100 thousand. It is noteworthy that the standardized mortality rate among older people aged ≥ 80 years

Table 1. Sociodemographic characteristics of older adults who suffered falls with consequent death in the period from 2000 to 2019 (n=135,209).

Variables	n	%
Sex		
Man	65,700	48.59
Woman	69,509	51.41
Age group (years)		
60–64 years old	11,208	8.29
65–69 years old	12,552	9.28
70–74 years old	15,288	11.31
75–79 years old	20,282	15.00
≥80 years old	75,879	56.12
Skin color		
White	88,017	65.10
Black	5,196	3.84
Asian	1,463	1.08
Mixed-race	34,168	25.27
Indigenous	158	0.12
Ignored	6,207	4.59
Level of education (years of formal study)		
Illiterate	24,850	18.38
1–3	31,216	23.09
4–7	26,233	19.40
8–11	12,181	9.01
≥12	4,858	3.59
Ignored	35,871	26.53
Marital status		
Single	20,017	14.80
Married	45,210	33.44
Widowed	54,144	40.04
Legally separated	6,478	4.79
Others	1,120	0.83
Ignored	8,240	6.09

Source: Brazilian Mortality Information System (SIM).

in 2017 (23.35/100 thousand) was the highest identified in the series (Table 2 and Figure 2).

In Table 3 we show the analysis of the trend of standardized mortality rates from falls in older adults in Brazil, from 2000 to 2019. We could observe that mortality from falls in older adults increased in the studied period ($\beta=0.023$; $p<0.001$; AIR=5.45%). When analyzing standardized mortality rates according to sex, we noticed an increasing trend for both groups, with the annual increase rate being higher among women. Regarding the age group, in all strata, the mortality trend was upward, highlighting that the annual increase rate was higher among older adults aged ≥80 years (Table 3).

DISCUSSION

Our findings point to an upward trend in the mortality rate from falls in older adults of both sexes, in the an-

alyzed period, with a higher annual increase rate in women. The results also showed an increasing mortality trend in all age strata, but higher in long-lived older adults. Although relevant scientific, technological, and social advances that had taken place in this century have contributed to the rapid aging of the population, especially in less developed regions of the world^{3,34,35}, it is noteworthy that longevity makes older people vulnerable to morbidity and mortality from falls³⁶.

In this study we analyzed the trend of mortality from falls in the population of older adults in Brazil in a time series of 20 years. The results suggest that this trend increased in the analyzed period, with an increase rate of 5.45% per year being observed. A recent study carried out in China by analysis of trends showed that, between 2013 and 2020, the mortality rate from falls in older adults also had an upward trend³⁷. Studies conducted in other countries, such as the United States of America, Canada, and Spain, also demonstrated an increasing trend in mortality from falls in older people^{6,38,39}. Similar data were also found in Brazilian studies that identified increasing mortality rates from falls in older adults in all regions of the country^{15,17,18}.

Among the main conditions associated with the increased risk of mortality from falls in this population are being woman, older, and single and/or widowed⁴⁰. We also found such conditions in this study, in relation to sex and age, which showed a greater annual increase in mortality rates from falls in women and in long-lived older people.

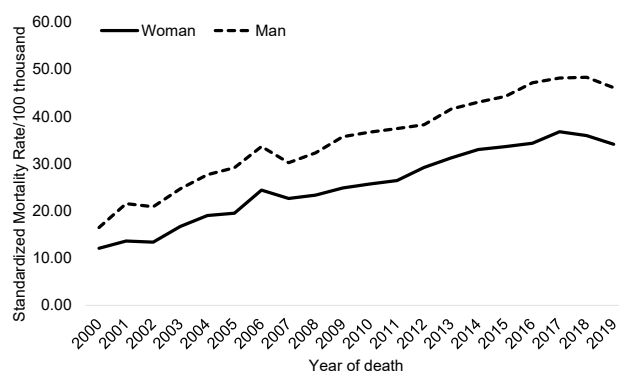
Despite advances of the Brazilian legislation on the health of older adults, health care for this group still has limitations^{41,42}. When analyzing the standardized mortality rates from falls in older people according to sex, we can verify that they were higher in men, although the annual increase rate in women was higher. Similar results were found in research developed by Abreu et al.¹⁷, Brasil¹⁸, Rosa et al.⁴⁰, and Gale et al.⁴³, who demonstrated that the mortality rate from falls in older adults is higher in men.

The possible explanations for differences in mortality from falls between sexes have been discussed by other authors^{23,43,44}. Gale et al.⁴³ suggest that mortality is higher among men because of the tendency to engage in intense, risky activities and the greater consumption of alcoholic beverages. Moreover, according to the literature, men's health has been discussed in studies, considering men's negligence concerning their health, in coping with diseases, in addition to their low understanding of the importance of male care practices — which, associated with the low adherence of this population to healthcare services, may lead to increased mortality rates in this group⁴⁴⁻⁴⁶. In this context, it is necessary to overcome this culture imposed by men themselves that disease is a sign of fragility, which leads them to neglect the process of illness and not to take care of their health, increasing

Table 2. Standardized rate of mortality from falls among older adults (per 100 thousand inhabitants), general and specific by sex and age group (in years), Brazil, 2000 to 2019 (n=135,209).

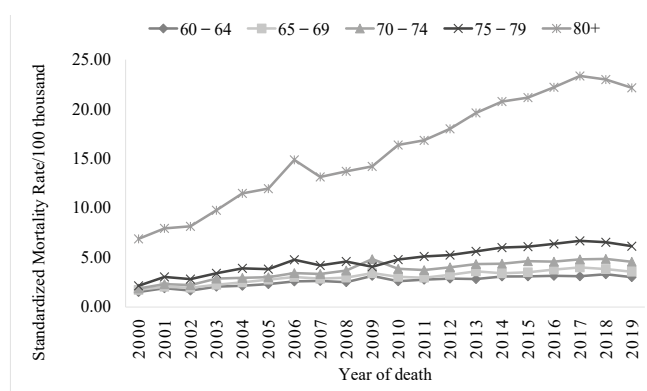
Year	Standardized Mortality Rate (SMR)							
	General	By sex		By age group (in years)				
		Woman	Man	60-64	65-69	70-74	75-79	≥80
2000	14.17	12.10	16.50	1.52	1.74	1.87	2.15	6.89
2001	17.28	13.65	21.57	1.90	2.05	2.32	3.05	7.95
2002	16.83	13.40	20.91	1.67	1.95	2.23	2.83	8.16
2003	20.40	16.73	24.71	2.06	2.26	2.88	3.41	9.79
2004	22.99	19.05	27.71	2.15	2.50	2.95	3.91	11.49
2005	23.91	19.54	29.19	2.32	2.77	3.02	3.83	11.97
2006	28.71	24.44	33.68	2.59	3.04	3.43	4.78	14.87
2007	26.21	22.66	30.25	2.64	2.86	3.35	4.22	13.15
2008	27.51	23.38	32.35	2.52	2.98	3.69	4.60	13.72
2009	29.72	24.89	35.75	3.15	3.43	4.85	4.07	14.21
2010	30.70	25.74	36.72	2.61	3.05	3.86	4.80	16.38
2011	31.44	26.46	37.48	2.77	2.97	3.74	5.12	16.85
2012	33.42	29.23	38.30	2.88	3.25	4.02	5.25	18.01
2013	36.03	31.26	41.62	2.83	3.61	4.34	5.63	19.62
2014	37.67	33.04	43.08	3.09	3.41	4.38	6.01	20.77
2015	38.52	33.66	44.29	3.10	3.52	4.63	6.11	21.17
2016	40.12	34.37	47.19	3.16	3.79	4.59	6.38	22.21
2017	41.99	36.81	48.19	3.11	4.00	4.82	6.69	23.35
2018	41.57	36.00	48.35	3.32	3.84	4.87	6.55	22.99
2019	39.47	34.15	46.14	3.02	3.57	4.58	6.15	22.15

Source: Brazilian Mortality Information System (SIM), 2021.



Source: Brazilian Mortality Information System (SIM), 2021.

Figure 1. Standardized rate of sex-specific mortality from falls in older adults in the period 2000 to 2019.



Source: Brazilian Mortality Information System (SIM), 2021.

Figure 2. Standardized rate of age-specific mortality from falls in older adults in the period 2000 to 2019.

mortality rates. Thus, policies and programs directed to men's health care must be improved, enhancing the conditions of this population and, therefore, reducing morbidity and mortality.

Regarding the annual increase rate, we observed that it was higher in women. The hypothesis for this finding may be related to: the lower amount of lean body mass and muscle strength; the postmenopausal period, with greater loss of bone mass due to the reduction of estrogen, increasing the possibility of osteoporosis and consequent fractures; the greater occurrence of chronic diseases; greater exposure to domestic activities; and emotional

changes, which can trigger the fall and, consequently, the risk of death^{47,48}.

In this investigation, we observed that mortality rates from falls tend to increase with advancing age. Studies carried out by Silva et al.⁴⁹, Gomes et al.⁵⁰, and Monteiro et al.⁵¹ corroborate this trend, reflecting the greater frailty and, consequently, the risk of death from falls among older adults.

Factors, such as loss of mass, strength, and quality of skeletal muscle, contribute to changes in gait and balance, increasing the risk of falls and loss of physical independence, losses that are accentuated with advancing age,

Table 3. Trends in standardized mortality rates from falls among older adults, general and specific by sex and age group, Brazil, 2000 to 2019.

Variable	Prais-Winsten				Annual Increase Rate (AIR%)				
	β	95%CI		p-value*	R ²	AIR%	95%CI		Trend
		Lower	Higher				Lower	Higher	
General	0.023	0.017	0.029	<0.001	0.849	5.45	4.09	6.82	Upward
By sex									
Man	0.022	0.017	0.027	<0.001	0.784	5.19	4.03	6.36	Upward
Woman	0.024	0.018	0.031	<0.001	0.846	5.72	4.15	7.32	Upward
By age group (years)									
60–64	0.015	0.010	0.019	<0.001	0.587	3.48	2.40	4.57	Upward
65–69	0.016	0.011	0.022	<0.001	0.262	3.80	2.52	5.10	Upward
70–74	0.019	0.013	0.025	<0.001	0.446	4.52	3.09	5.98	Upward
75–79	0.022	0.017	0.026	<0.001	0.809	5.10	4.04	6.17	Upward
≥80	0.027	0.021	0.033	<0.001	0.735	6.38	4.85	7.94	Upward

95%CI: confidence interval; R²: coefficient of determination; AIR: average annual percentage increase rate; *Significance level $p < 0.05$.

contributing to the increased incidence of falls in older people. Body balance is maintained by the integration of sensory information retained by the vision, vestibular system, in addition to muscle strength. With the aging process, there are physiological changes inherent in the decline in muscle strength, which can be identified as factors responsible for the higher incidence of falls in this group. Furthermore, a sedentary lifestyle, which is frequent in the older adult population, contributes to the deterioration of postural control⁵².

Falls in older adults mainly result from the lack of clinical conditions or an unsafe environment, or even from the combination of these two factors. Aging alone is not a cause of falls, although the physiological changes resulting from aging favor their occurrence¹².

Population aging, when not followed by appropriate infrastructure adjustments and other measures that facilitate mobility and promote the quality of life of this population, can contribute to an increase in the number of deaths as a result of such conditions. It is known that precarious public roads, with broken and irregular sidewalks and poor lighting, together with intrinsic factors originating from the senescence process, compose a scenario that leads to more episodes of falls, increasing mortality rates from this cause, which deserves special attention on the part of healthcare managers and professionals⁵³⁻⁵⁵.

Within this context, the prevention of deaths from falls in this population necessarily involves the prevention of falls. There is evidence that physical exercise has a protective effect, especially in the long-term and if regularly practiced, improving aspects related to balance and functionality⁵⁶. Moreover, screening for the risk of falls in routine care for older adults can also help to identify those who are most exposed to falls⁵⁷. Primary health care, with its great capillarity and coverage⁵⁸, plays a key role in this context, especially considering its territorialization process and its own attributes, including home visits⁵⁹, which

even allows the assessment of risks existing in the household itself.

One of the limitations of studies that use databases from DATASUS mainly refers to incompleteness in the filling-out process. In addition to the possibility of underreporting of deaths and problems in the flow of data and its consolidation in DATASUS⁶⁰. However, as a strength, our study relies on the use of a quality national registry, which includes an expressive and robust final population, in addition to a historical series of 20 years, which can support health managers in the review and creation of policies on health care for this specific population.

Our evidence reinforces the challenges of the health system and indicates the need to increase the provision of care related to health promotion and risk prevention for falls in older adults. It should be noted that preventing the increase in mortality of older adults from accidental falls is among the goals of the Strategic Action Plans for Tackle Chronic Diseases and Noncommunicable Diseases in Brazil 2021-2030¹⁸. Taking this into consideration, intersectoral actions should be encouraged and implemented.

Hence, we observed that preventable causes of death have become an important indicator to evaluate health-care services, and the study showed an upward trend in mortality rates from falls in older adults in the country and that sex- and age-specific mortality rates were also increasing. The main hypotheses for these findings concern the increase in the burden of diseases, deficiencies, and frailties among the Brazilian population of older people. There is evidence that the considerable increase in the prevalence of chronic diseases in older adults is an expected event; nonetheless, we must consider that the increase in the proportion of overweight and obese individuals is related to new challenges in the management of care to older people⁶¹, as this condition predisposes the individual to develop diseases such as those of the circulatory system, neoplasms (tumors), and diseases of the respiratory system⁶².

Although evidence suggests a decrease in deaths from cardiovascular diseases and chronic respiratory diseases, we must bear in mind that mortality rates are following a stable pattern mainly attributable to functional decline, hearing loss, back pain, and injuries due to falls⁶³.

Global monitoring of risk factors for mortality and morbidity, especially related to falls in older adults, is crucial to support and advance research and policies on health care for older adults. Therefore, our findings suggest the importance of defining a line of care for this age group, focusing on promoting health in older adults and preventing the risk of falls, aiming at a reduction in the number of deaths from this cause and favoring the quality of life of this population.

REFERENCES

- World Health Organization. Ageing. Geneva: World Health Organization [Internet] 2015. [cited on Nov. 07, 2021]. Available at: <https://www.who.int/ageing/en>
- World Health Organization. Ageing and health. Geneva: World Health Organization [Internet] 2021. [cited on Jan. 20, 2022]. Available at: <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>
- Brasil. Instituto Brasileiro de Geografia e Estatística. Projeções populacionais. Rio de Janeiro: IBGE [Internet] 2018. [cited on Nov. 07, 2021]. Available at: <https://www.ibge.gov.br/estatisticas/sociais/populacao/9109-projecao-da-populacao.html?edicao=9116&t=resultados>
- Alves JED. Envelhecimento populacional no Brasil e no mundo. Novas projeções da ONU. Revista Longevidade 2019; 5-9 [cited on Jan. 28, 2022]. Available at: <https://revistalongevidade.com.br/index.php/revistaportal/article/viewFile/787/842>
- Duarte GP, Santos JLF, Lebrão ML, Duarte YAO. Relationship of falls among the elderly and frailty components. Rev Bras Epidemiol 2018; 21(suppl 2): E180017. <https://doi.org/10.1590/1980-549720180017.supl.2>
- Burns ER, Stevens JA, Lee R. The direct costs of fatal and non-fatal falls among older adults-United States. J Safety Res 2016; 58: 99-103. <https://doi.org/10.1016/j.jsr.2016.05.001>
- Liu-Ambrose T, Khan KM, Eng JJ, Janssen PA, Lord SR, McKay HA. Resistance and agility training reduce fall risk in women aged 75 to 85 with low bone mass: a 6-month randomized, controlled trial. J Am Geriatr Soc 2004; 52(5): 657-65. <https://doi.org/10.1111/j.1532-5415.2004.52200.x>
- Vieira AAU, Aprile MR, Paulino CA. Exercício físico, envelhecimento e quedas em idosos: revisão narrativa. Rev Equilíbrio Corporal Saúde 2014; 6(1): 23-31. <https://doi.org/10.17921/2176-9524.2014v6n1p%25p>
- Tiedemann A, Sherrington C, Lord SR. The role of exercise for fall prevention in older age. Motriz 2013; 19(3): 541-7. <https://doi.org/10.1590/S1980-65742013000300002>
- Sociedade Brasileira de Geriatria e Gerontologia. Projeto diretrizes. Associação Médica Brasileira e Conselho Federal de Medicina. Quedas em idosos: prevenção. [Internet] 2008. [cited on Jan. 09, 2022]. Available at: <https://sbogg.org.br/wp-content/uploads/2014/10/queda-idosos.pdf>
- Hernández JG, de las Casas MOP, Pérez MTM, Díaz DB, Lara CM, Coello SD. ¿Podemos desde atención primaria prevenir las caídas en las personas mayores? Atención Primaria 2010; 42(5): 284-91. <https://doi.org/10.1016/j.aprim.2009.08.003>
- Almeida ST, Soldera CLC, Carli GA, Gomes I, Resende TL. Analysis of extrinsic and intrinsic factors that predispose elderly individuals to fall. Rev Assoc Med Bras (1992) 2012; 58(4): 427-33. <https://doi.org/10.1590/S0104-42302012000400012>
- Gomes ECC, Marques APO, Leal MCC, Barros BP. Fatores associados ao risco de quedas em idosos institucionalizados: uma revisão integrativa. Ciênc Saúde Colet 2014; 19(8): 3543-51. <https://doi.org/10.1590/1413-81232014198.16302013>
- Monteiro YCM, Vieira MAS, Vitorino PVO, Queiroz SJ, Policena GM, Souza ACS. Trend of fall-related mortality among the elderly. Rev Esc Enferm USP 2021; 55: e20200069. <https://doi.org/10.1590/1980-220X-REEUSP-2020-0069>
- Stolt LROG, Kolisch DV, Tanaka C, Cardoso MRA, Schmitt ACB. Increase in fall-related hospitalization, mortality, and lethality among older adults in Brazil. Rev Saúde Pública 2020; 54(76): 1-12. <https://doi.org/10.11606/s1518-8787.2020054001691>
- Tristão KM, Leite FMC, Schimldt ER, Leite EC, Castro DS, Vilela APM. Mortalidade por causas externas na microrregião de São Mateus, estado do Espírito Santo, Brasil: tendências de 1999 a 2008. Epidemiol Serv Saúde 2012; 21(2): 305-13. <http://dx.doi.org/10.5123/S1679-49742012000200013>
- Abreu DROM, Novaes ES, Oliveira RR, Mathias TAF, Marcon SS. Fall-related admission and mortality in older adults in Brazil: trend analysis. Ciênc Saúde Colet 2018; 23(4): 1131-41. <https://doi.org/10.1590/1413-81232018234.09962016>
- Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Análise em Saúde e Vigilância de Doenças Não-Transmissíveis. Plano de ações estratégicas para o enfrentamento das doenças crônicas e agravos não transmissíveis no Brasil, 2021-2030. Brasília: Ministério da Saúde; 2021. [cited on Jan. 20, 2022]. Available at: https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/publicacoes-svs/doencas-cronicas-nao-transmissiveis-dcnt/09-plano-de-dant-2022_2030.pdf/@download/file/relatorio_monitoramento_11_2021%20-%20plano%20de%20dant.pdf
- Gabidou E, Afshin A, Abajobir AA, Abate KH, Abbafati C, Abbas KM, et al. Global, regional, and national comparative risk assessment of 79 behavioral, environmental and occupational, and metabolic risks or clusters of risks, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. The Lancet 2017; 390(10100): 1345-422. [https://doi.org/10.1016/S0140-6736\(17\)32366-8](https://doi.org/10.1016/S0140-6736(17)32366-8)

20. Paiva MM, Lima MG, Barros MBA. Quedas e qualidade de vida relacionada à saúde em idosos: influência do tipo, frequência e local de ocorrência das quedas. *Ciênc Saúde Coletiva* 2021; 26(Supl 3): 5099-108. <https://doi.org/10.1590/1413-812320212611.3.29902019>
21. Lima JS, Quadros DV, Silva SLC, Tavares JP, Dal Pai D. Costs of hospital admission authorizations due to falls among older people in the Brazilian National Health System, Brazil, 2000-2020: a descriptive study. *Epidemiol Serv Saúde* 2022; 31(1): e2021603. <https://dx.doi.org/10.1590/s1679-49742022000100012>
22. Organização Mundial da Saúde. Relatório Global da OMS sobre prevenção de quedas na velhice. São Paulo: Secretaria de Estado da Saúde de São Paulo [Internet]. 2010. [cited on June 22, 2022]. Available at: https://bvsmms.saude.gov.br/bvs/publicacoes/relatorio_prevencao_quedas_velhice.pdf
23. Brasil. Ministério da Saúde. Gabinete do Ministro. Portaria nº 399, de 22 de fevereiro de 2006. Divulga o Pacto pela Saúde 2006 – Consolidação do SUS e aprova as Diretrizes Operacionais do Referido Pacto [Internet] 2006. [cited on Jan. 28, 2022]. Available at: https://bvsmms.saude.gov.br/bvs/saudelegis/gm/2006/prt0399_22_02_2006.html
24. Sousa NFS, Lima MG, Cesar CLG, Barros MBA. Active aging: prevalence and gender and age differences in a population-based study. *Cad Saude Publica* 2018; 34(11): e00173317. <https://doi.org/10.1590/0102-311X00173317>
25. Torres KRBO, Campos MR, Luiza VL, Caldas CP. Evolução das políticas públicas para a saúde do idoso no contexto do Sistema Único de Saúde. *Physis* 2020; 30(1): e300113. <https://doi.org/10.1590/S0103-73312020300113>
26. Gomes ECC, Marques APO, Leal MCC, Barros BP. Fatores associados ao risco de quedas em idosos institucionalizados: uma revisão integrativa. *Ciênc Saúde Colet* 2014; 19(8): 3543-51. <https://doi.org/10.1590/1413-81232014198.16302013>
27. Antes DL, Schneider IJC, d'Órsi E. Mortality caused by accidental falls among the elderly: a time series analysis. *Rev Bras Geriatr Gerontol* 2015; 18(4): 769-78. <https://doi.org/10.1590/1809-9823.2015.14202>
28. Silva FMA, Safons MP. Mortality from falls in the elderly in the Federal District, Brazil: characteristics and time trend, 1996-2017. *Epidemiol Serv Saúde* 2022; 31(1): e2021681. <https://dx.doi.org/10.1590/s1679-49742022000100003>
29. Brasil. Ministério da Saúde. Datasus. Tecnologia da Informação a Serviço do SUS. Sistema de Informação de Mortalidade (SIM). Informações de Saúde. Mortalidade – Brasil. [cited on Oct. 15, 2021] Available at: <http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sim/cnv/obt10uf.def>
30. Organização Mundial da Saúde. Classificação Estatística Internacional de Doenças e Problemas relacionados à Saúde – CID-10. São Paulo: Editora da Universidade de São Paulo; 1994.
31. Curtin LR, Klein RJ. Direct standardization (age-adjusted death rates). *Healthy People 2000 Stat Notes* 1995; (6): 1-10. PMID: 11762384
32. Ahmad OB, Boschi-Pinto C, Lopez AD, Murray CJL, Lozano R, Inoue M. Age standardization of rates: a new WHO standard. *GPE Discuss Pap Ser No 31*. World Health Organization; 2001. [cited on Sept. 12, 2022] Available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKewisyImks5D6AhUBhJUCHeF3Ar8QFnoECAUQAQ&url=https%3A%2F%2Fcdn.who.int%2Fmedia%2Fdocs%2Fdefault-source%2Fgho-documents%2Fglobal-health-estimates%2Fgpe_discussion_paper_series_paper31_2001_age_standardization_rates.pdf&usq=AOVvaw0Z68dFH4rGfGtGxV_sxot
33. Antunes JLF, Cardoso MRA. Uso da análise de séries temporais em estudos epidemiológicos. *Epidemiol Serv Saúde* 2015; 24(3): 565-76. <https://doi.org/10.5123/S1679-49742015000300024>
34. United Nations. Department of Economic and Social Affairs. World population ageing 2019. Highlights. New York: United Nations; 2019. [cited on Dec. 16, 2021]. Available at: <https://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2019-Highlights.pdf>
35. Veloso MV, Sousa NFS, Medina LPB, Barros MBA. Income inequality and functional capacity of the elderly in a city in Southeastern Brazil. *Rev Bras Epidemiol* 2020; 23: E200093. <https://doi.org/10.1590/1980-549720200093>
36. Miranda GMD, Mendes ACG, Silva ALA. Population aging in Brazil: current and future social challenges and consequences. *Rev Bras Geriatr Gerontol* 2016; 19(3): 507-19. <https://doi.org/10.1590/1809-98232016019.150140>
37. Zhang K, Qi J, Zuo P, Yin P, Liu Y, Liu J, et al. The mortality trends of falls among the elderly adults in the mainland of China, 2013-2020: a population-based study through the National Disease Surveillance Points system. *Lancet Reg Health West Pac* 2021; 19: 100336. <https://doi.org/10.1016/j.lanwpc.2021.100336>
38. Chen Y, Mo F, Yi QL, Jiang Y, Mao Y. Unintentional injury mortality and external causes in Canada from 2001 to 2007. *Chronic Dis Inj Can* 2013; 33(2): 95-102. <http://dx.doi.org/10.24095/HPCDP.33.2.06>
39. Padrón-Monedero A, Damián J, Martín MP, Fernández-Cuenca R. Mortality trends for accidental falls in older people in Spain, 2000-2015. *BMC Geriatr* 2017; 17(1): 276. <https://doi.org/10.1186/s12877-017-0670-6>
40. Rosa TSM, Moraes AB, Peripolli A, Santos Filha VAV. Perfil epidemiológico de idosos que foram a óbito por queda no Rio Grande do Sul. *Rev Bras Geriatr Gerontol* 2015; 18(1): 59-69. <https://doi.org/10.1590/1809-9823.2015.14017>
41. Brasil. Ministério da Saúde. Diretrizes para o cuidado das pessoas idosas no SUS: proposta de modelo de atenção integral. XXX Congresso Nacional de Secretarias Municipais de Saúde. Brasília: Ministério da Saúde; 2014. [cited on Jan. 24, 2022]. Available at: https://bvsmms.saude.gov.br/bvs/publicacoes/diretrizes_cuidado_pessoa_idosa_sus.pdf

42. Coelho LP, Motta LB, Caldas CP. Rede de atenção ao idoso: fatores facilitadores e barreiras para implementação. *Physis* 2019; 28(4): e280404. <https://doi.org/10.1590/S0103-73312018280404>
43. Gale CR, Westbury LD, Cooper C, Dennison EM. Risk factors for incident falls in older men and women: the English longitudinal study of ageing. *BMC Geriatr* 2018; 18(1): 117. <https://doi.org/10.1186/s12877-018-0806-3>
44. Levorato CD, Mello LM, Silva AS, Nunes AA. Fatores associados à procura por serviços de saúde numa perspectiva relacional de gênero. *Ciênc Saúde Coletiva* 2014; 19(4): 1263-74. <https://doi.org/10.1590/1413-81232014194.01242013>
45. Alves AN, Coura AS, França ISX, Magalhães IMO, Rocha MA, Araújo RS. Access of first contact in the primary health care: an evaluation by the male population. *Rev Bras Epidemiol* 2020; 23: E200072. <https://doi.org/10.1590/1980-5497202000072>
46. Brasil. Ministério da Saúde. Política nacional de atenção integral à saúde do homem: princípios e diretrizes. Brasília: Editora do Ministério da Saúde; 2009. [cited on Jan. 23, 2022]. Available at: http://www.unfpa.org.br/Arquivos/saude_do_homem.pdf
47. Perracini MR. Desafio da prevenção e do manejo de quedas em idosos. *Bol Inst Saúde* 2009; 47: 45-8.
48. Leitão SM, Oliveira SC, Rolim LR, Carvalho RP, Coelho Filho JM, Peixoto Junior AA. Epidemiology of falls in older adults in Brazil: an integrative literature review. *Geriatr Gerontol Aging* 2018; 12(3): 172-9. <https://doi.org/10.5327/Z2447-211520181800030>
49. Silva VL, Albuquerque MFPM, Cesse EAP, Luna CF. Perfil de mortalidade do idoso: análise da evolução temporal em uma capital do Nordeste brasileiro de 1996 a 2007. *Rev Bras Geriatr Gerontol* 2012; 15(3): 433-41. <https://doi.org/10.1590/S1809-98232012000300005>
50. Gomes LMX, Barbosa TLA, Caldeira AP. Mortalidade por causas externas em idosos em Minas Gerais, Brasil. *Esc Anna Nery* 2010; 14(4): 779-86. <https://doi.org/10.1590/S1414-81452010000400018>
51. Monteiro ACL, Sarmiento WE, Queiroga ND, Machado HCL, Pereira DA, Lima SMF, et al. Envelhecimento populacional: efetivação dos direitos na terceira idade. *Revista Pubvet* 2018; 12(2): 1-8. <https://doi.org/10.22256/pubvet.v12n2a29.1-8>
52. Ferretti F, Lunardi D, Bruschi L. Causes and consequences of fall among elderly people at home. *Fisioter Mov* 2013; 26(4): 753-62. <https://doi.org/10.1590/S0103-51502013000400005>
53. Philips J, Walford N, Hockey A, Foreman N, Lewis M. Older people and outdoor environments: pedestrian anxieties and barriers in the use of familiar and unfamiliar spaces. *Geoforum* 2013; 47: 113-24. <https://doi.org/10.1016/j.geoforum.2013.04.002>
54. Meschial WC, Soares DFPP, Oliveira NLB, Nespollo AM, Silva WA, Santil FLP. Elderly victims of falls seen by prehospital care: gender differences. *Rev Bras Epidemiol* 2014; 17(1): 3-16. <https://doi.org/10.1590/1415-790X201400010002ENG>
55. Park SH. Tools for assessing fall risk in the elderly: a systematic review and meta-analysis. *Aging Clin Exp Res* 2018; 30(1): 1-16. <https://doi.org/10.1007/s40520-017-0749-0>
56. Bento JR, Sousa ND. Exercício físico na prevenção de quedas do idoso da comunidade: revisão baseada na evidência. *Rev Bras Med Fam Comunidade* 2017; 12(39): 1-11. [https://doi.org/10.5712/rbmf12\(39\)1658](https://doi.org/10.5712/rbmf12(39)1658)
57. Falsarella GR, Gasparotto LPR, Coimbra AMV. Quedas: conceitos, frequências e aplicações à assistência ao idoso. Revisão da literatura. *Rev Bras Geriatr Gerontol* 2014; 17(4): 897-910. <https://doi.org/10.1590/1809-9823.2014.13064>
58. Giovanela L, Bousquat A, Schenkman S, Almeida PF, Sardinha LMV, Vieira MLFP. The Family Health Strategy coverage in Brazil: what reveal the 2013 and 2019 National Health Surveys. *Cien Saude Colet* 2021; 26(suppl 1): 2543-56. <https://doi.org/10.1590/1413-81232021266.1.43952020>
59. Gallassi CV, Ramos DFH, Kinjo JY, Souto BGA. Atenção domiciliar na atenção primária à saúde: uma síntese operacional. *ABCS Health Sci* 2014; 39(3): 177-85. <http://doi.org/10.7322/abcshs.v39i3.653>
60. Soares Filho AM, Bermudez XP, Merchan-Hamann E. Frequency and factors associated with recording deaths due to unspecified external causes in Brazil: a cross-sectional study, 2017. *Epidemiol Serv Saúde* 2021; 30(2): e2020452. <https://doi.org/10.1590/S1679-49742021000200020>
61. Araújo TA, Oliveira IM, Silva TGV, Roediger MA, Duarte YAO. Health conditions and weight change among the older adults over ten years of the SABE survey. *Epidemiol Serv Saude* 2020; 29(4): e2020102. <http://doi.org/10.1590/S1679-49742020000400012>
62. Franscisci RPP, Pereira LO, Freitas CS, Klopfer M, Santos RC, Vieira P, et al. Obesidade: atualização sobre sua etiologia, morbidade e tratamento. *Rev Nutr* 2000; 13(1): 17-28. <https://doi.org/10.1590/S1415-52732000000100003>
63. Tyrovolas S, Stergachis A, Krish VS, Chang AY, Skirbekk V, Dieleman JL, et al. Global, regional, and national burden of diseases and injuries for adults 70 years and older: systematic analysis for the Global Burden of Disease 2019 Study. *BMJ* 2022; 376: e068208. <https://doi.org/10.1136/bmj-2021-068208>

RESUMO

Objetivo: Analisar a tendência da mortalidade por quedas entre idosos, no Brasil, no período de 2000 a 2019. **Métodos:** Trata-se de um estudo epidemiológico, analítico, com delineamento ecológico de séries temporais. Realizou-se uma análise retrospectiva utilizando dados secundários em saúde, extraídos do Sistema de Informação sobre Mortalidade (SIM) no período específico. Foram calculadas taxas padronizadas de mortalidade geral e específicas por sexo e faixa etária. Para a observação da tendência de mortalidade, utilizou-se o modelo de Prais-Winsten e taxa de incremento anual (TIA). **Resultados:** No período de 2000 a 2019, foram identificados 135.209 óbitos decorrentes das quedas em idosos. A mortalidade por queda em geral, no período estudado, foi crescente ($\beta=0,023$; $p<0,001$; TIA=5,45%). Observou-se que tanto o sexo masculino ($\beta=0,022$; $p<0,001$; TIA=5,19%) quanto o feminino ($\beta=0,024$; $p<0,001$; TIA=5,72%) apresentaram tendência crescente. Com relação à faixa etária, os resultados apontaram também para tendência de mortalidade crescente em todos os estratos etários, porém maior em idosos com idade ≥ 80 anos ($\beta=0,027$; $p<0,001$; TIA=6,38%). **Conclusão:** Observou-se tendência crescente nas taxas de mortalidade no Brasil durante a série histórica estudada. Esses achados sugerem a importância da definição de uma linha de cuidado para esse segmento etário, tendo como foco a promoção da saúde na pessoa idosa e a prevenção dos riscos de quedas, visando a uma redução no número de óbitos por essa causa e favorecendo a qualidade de vida dos idosos.

Palavras-chave: Epidemiologia. Distribuição temporal. Mortalidade. Acidentes por quedas. Idoso.

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