EPIDEMIOLOGICAL ASSESSMENT OF HOSPITALIZATIONS DUE TO FALLS AMONG THE ELDERLY IN THE MESOREGION OF THE NORTHWEST OF THE STATE OF RIO DE JANEIRO, BRAZIL

ABSTRACT

Background and Aim: Falls are one of the leading causes of disability and mortality among the elderly. Risk factors for falls are multifactorial, and classified into intrinsic and extrinsic factors. The aim of this research is to investigate, using already available general public health data, the epidemiological aspects of fall-related hospitalizations among elderly individuals admitted to the Northwest mesoregion of the state of Rio de Janeiro, to establish the groundwork for future studies with specific evaluation methodologies
the development of more appropriate Public Health policies.

Methods: The research was based on the data obtained from the Hospital Information System (DataSUS) and the 2022 census from the Brazilian Institute of Geography and Statistics (IBGE), assessing hospitalizations due to falls among individuals aged 60 and over in the Mesoregion of the Northwest of Rio de Janeiro between 2014 and 2023. The data were compiled for analysis of demographic distribution, fall incidence, gender distribution, and mortality rate.

Results: Significant variations in hospitalization rates were observed. Disparities in incidence rates were attributed to different degrees of exposure to risks considered as extrinsic factors predisposing to falls. The distribution of incidences by gender and age groups reflected trends observed in similar research, with women and individuals over 80 years old disproportionately requiring hospitalization. The mortality rate among elderly hospitalized for falls was 3.5%, lower than the national average.

Conclusion: The epidemiological analysis highlights the need for more effective Public Health interventions in Miracema and Itaocara. While some municipalities have succeeded in preventing falls among the elderly, others still face challenges. Sharing experiences among Municipal Health Departments, resource cooperation, joint planning of regional actions, and collaborative governance are recommended strategies to mitigate this serious Public Health issue.

Keywords: Falls, Elderly, Rio de Janeiro, Epidemiology, Public Health

1. INTRODUCTION

The World Health Organization defines falls as events in which an individual unintentionally rests on the ground, floor, or other lower level, excluding intentional changes in position to rest on furniture, walls, or other objects [1,2,3]. The consequences of falls can be severe, leading to injuries such as fractures, reduced mobility, disability, and even death, particularly in frail elderly individuals [4,5]. The causes are multifactorial and can result in physical and psychological consequences, including hospitalizations, restriction of usual activities, institutionalization, injuries, and functional decline [6,7,8,9].

There are various underlying or predisposing factors for falls in the elderly. Among intrinsic factors, the following stand out: clinical conditions with degradation of strength and mobility, such as sarcopenia and arthritis [10,11,12]; foot disorders [13]; alterations in the balance and coordination system, such as vestibular disorders and peripheral neuropathy [14,15,16]; chronic diseases such as hypertension, diabetes, or Parkinson's disease [17,18,19]; vision or hearing problems, such as cataracts, macular degeneration, hearing loss, misuse of glasses or hearing aids [20,21,22]; and cognitive decline, such as dementia or Alzheimer's disease [7,8,9,23]. Additionally, there is a higher risk for individuals with a history of previous falls and cerebrovascular accidents [23,24,25] and psychological aspects such as the fear of falling [7,26].

Extrinsic factors can decisively influence the prevalence rates of falls among the elderly. Some of the most important extrinsic factors are: uneven floors and objects that obstruct or hinder the individual's path, insufficient lighting, inappropriate footwear, slippery floors, lack of walking assistance equipment such as walkers, canes, or handrails, and use of medications that affect gait or balance such as hypnotics, anxiolytics, and neuroleptics [3,7,8,9,27,28,29]. Furthermore, elderly individuals who fall and develop severe clinical conditions requiring hospitalization often exhibit a reduced metabolic state, with low bodily reserves and consequently greater frailty [30,31,32], making them more prone to fall events. Poh and Shorey [29] identified a gap in the current scientific literature that considers intrinsic and extrinsic factors in an integrated analysis. Thus, the lack of joint evaluation of these factors, underestimation of one class of factors, or differing methodologies in various studies can bias the outcome analyses.

In the context of Public Health, accidental falls in the elderly and their consequences constitute one of the main causes of disability. These events significantly reduce the quality of life, increase morbidity and mortality rates, overload health services, lead to loss of independence, and cause psychological impacts on affected individuals, thereby reducing their quality of life. Due to the age of individuals most prone to this type of accident, the recovery time tends to be longer, resulting in higher costs for health services and impaired social activity [33,34,35,36]. Falls are the leading cause of injury-related morbidity and mortality among people aged 65 years and older, with approximately 80% of fall-related deaths occurring in low- and middle-income countries [37, 118-120]. Among health professionals in the northwest mesoregion of Rio de Janeiro, there is a perception that the incidence of such accidents varies across municipalities. This suspicion prompted an investigation using already available general public health data to verify this hypothesis and establish the basis for future studies with specific evaluation methodologies. The goal is to determine the adoption of more effective public health policies and actions to address this type of accident among the elderly and to meet the special needs in the event of hospitalization. Thus, understanding the epidemiology of falls among the elderly is an important tool for designing effective Public Health policies for the prevention, mitigation, and preparation of the health system for this population segment. The objective of this research is to verify, through the consolidation of data from the Public Health system and the Brazilian Institute of Geography and Statistics, epidemiological aspects of hospitalizations due to falls of elderly individuals in the northwest mesoregion of the state of Rio de Janeiro, Brazil, to establish the basis for more appropriate Public Health policies.

2. METHODS

This investigation is a cross-sectional, retrospective, and descriptive epidemiological study. Information was acquired through the Hospital Information System DataSUS[38] and the 2022 demographic census data from the Brazilian Institute of Geography and Statistics [39]. All hospitalizations due to falls among individuals aged 60 years or older in the cities that constitute the Mesoregion of the Northwest of Rio de Janeiro between 2014 and 2023 were evaluated. Data compilation was performed using Microsoft Excel software to determine, in separate spreadsheets, the proportional demographic distribution by age group of the elderly in each city within the mesoregion, the incidence of hospitalizations due to falls, the temporal incidence of falls, the proportional projection of falls per 100,000 patients per city, the gender distribution of fall-related hospitalization events, and the mortality rate among elderly patients hospitalized for falls during the specified period. The gathered and organized data were presented using graphs and a table to ease the understanding and interpretation of the results. Given that this research is based on secondary data, with complete anonymity, and sourced from publicly accessible databases, supervision by a Research Ethics Committee is considered unnecessary. The results were critically analyzed and compared with other findings from scientific studies on the topic in the discussion.

3. RESULTS

By consulting data from the Brazilian Institute of Geography and Statistics (IBGE) and the Hospital Information System of the Unified Health System (SIH/SUS), we systematized the results and presented them in the form of graphs and a table. These were used to analyze variables related to hospitalizations of the elderly due to falls in the Mesoregion of the Northwest of Rio de Janeiro from 2014 to 2023.

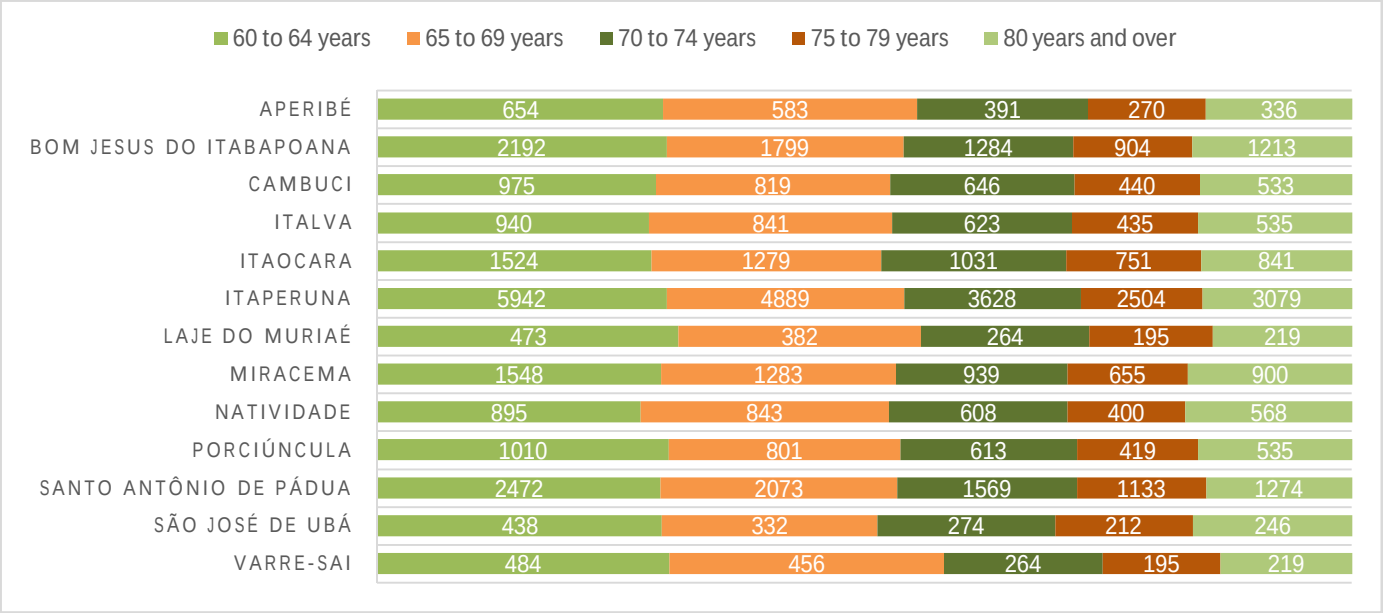

Fig. 1 – Proportional distribution of the total elderly population in the Mesoregion of the Northwest of Rio de Janeiro according to age group.

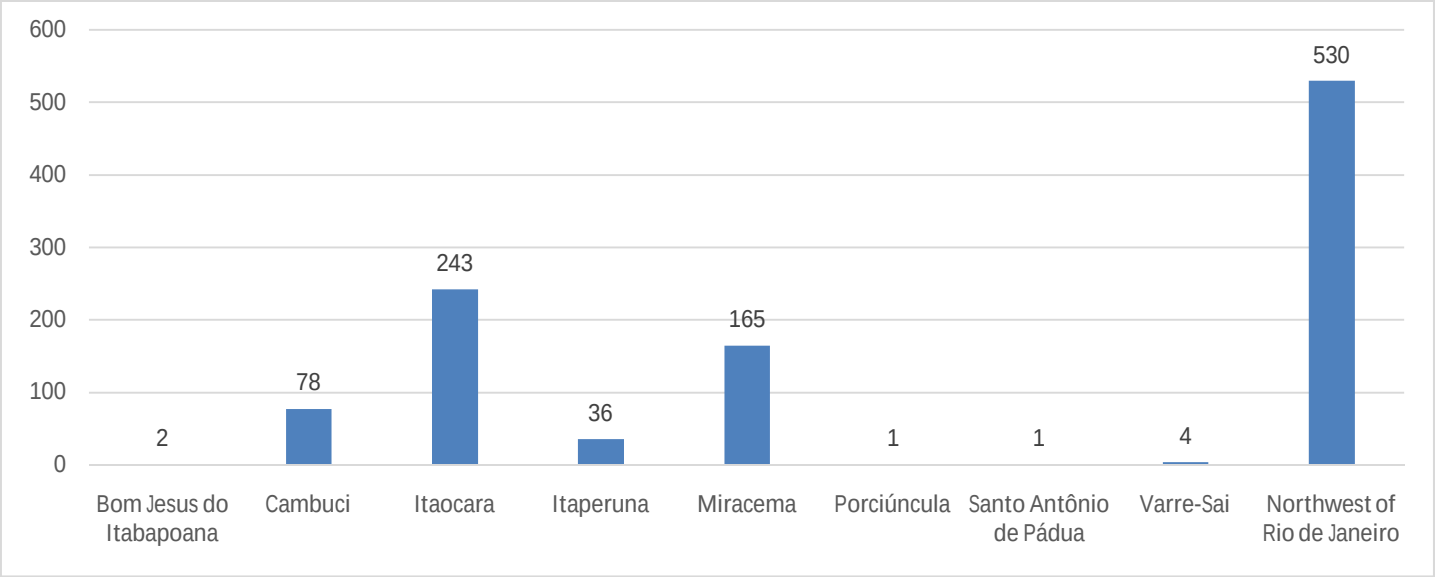

Fig. 2 – Absolute number of hospitalizations due to falls in the elderly population of the Mesoregion of the Northwest of Rio de Janeiro by city between 2014 and 2023.

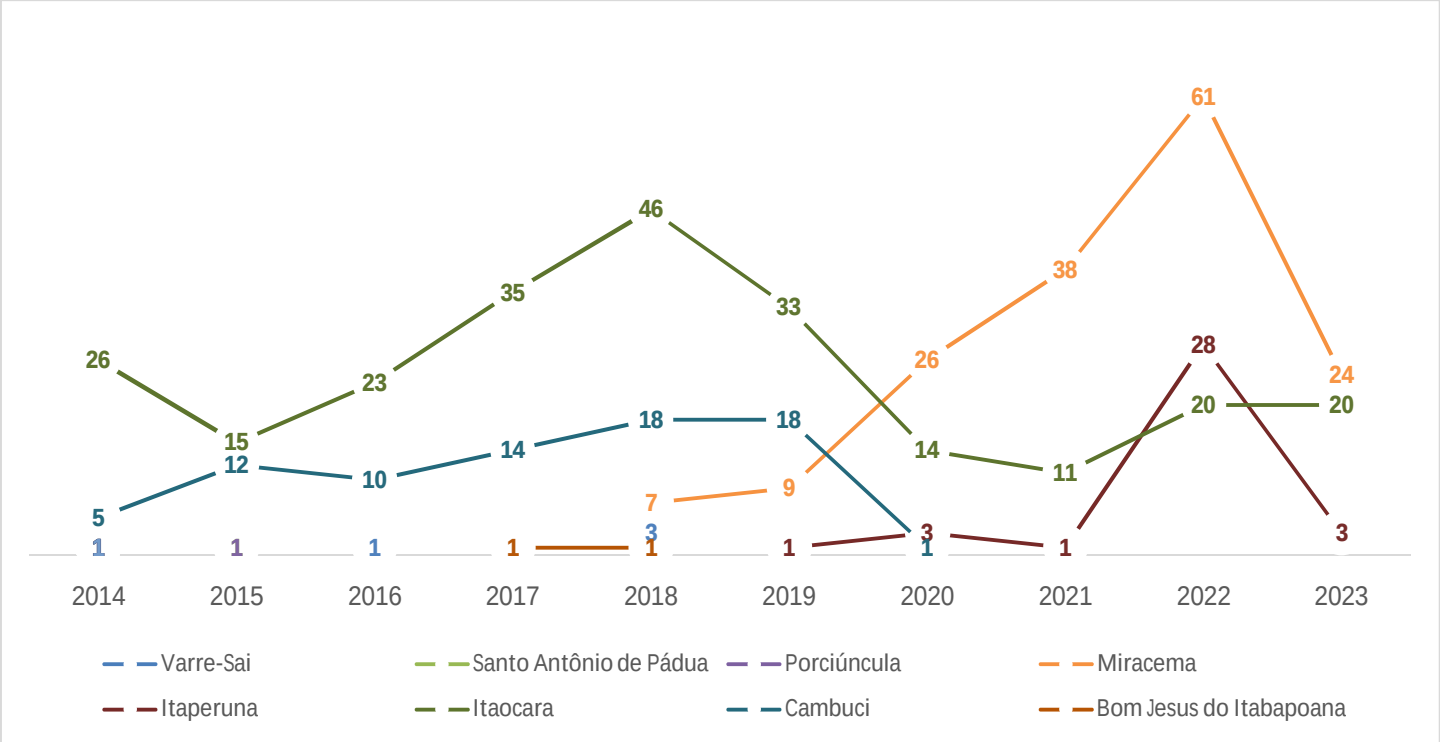

Fig. 3 – Temporal distribution of hospitalizations due to falls in the elderly population of the Mesoregion of the Northwest of Rio de Janeiro by city between 2014 and 2023.

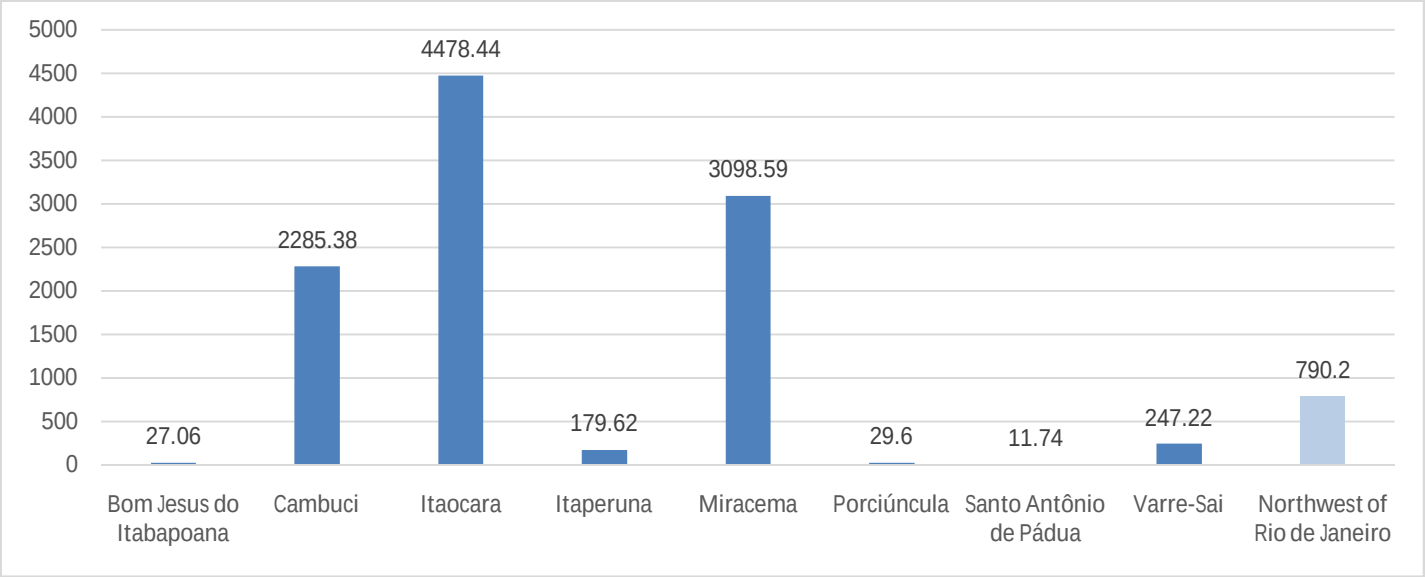

Fig. 4 – Projection of the number of hospitalizations due to falls per 100,000 elderly individuals in the Mesoregion of the Northwest of Rio de Janeiro in cities with records of hospitalizations due to falls between 2014 and 2023.

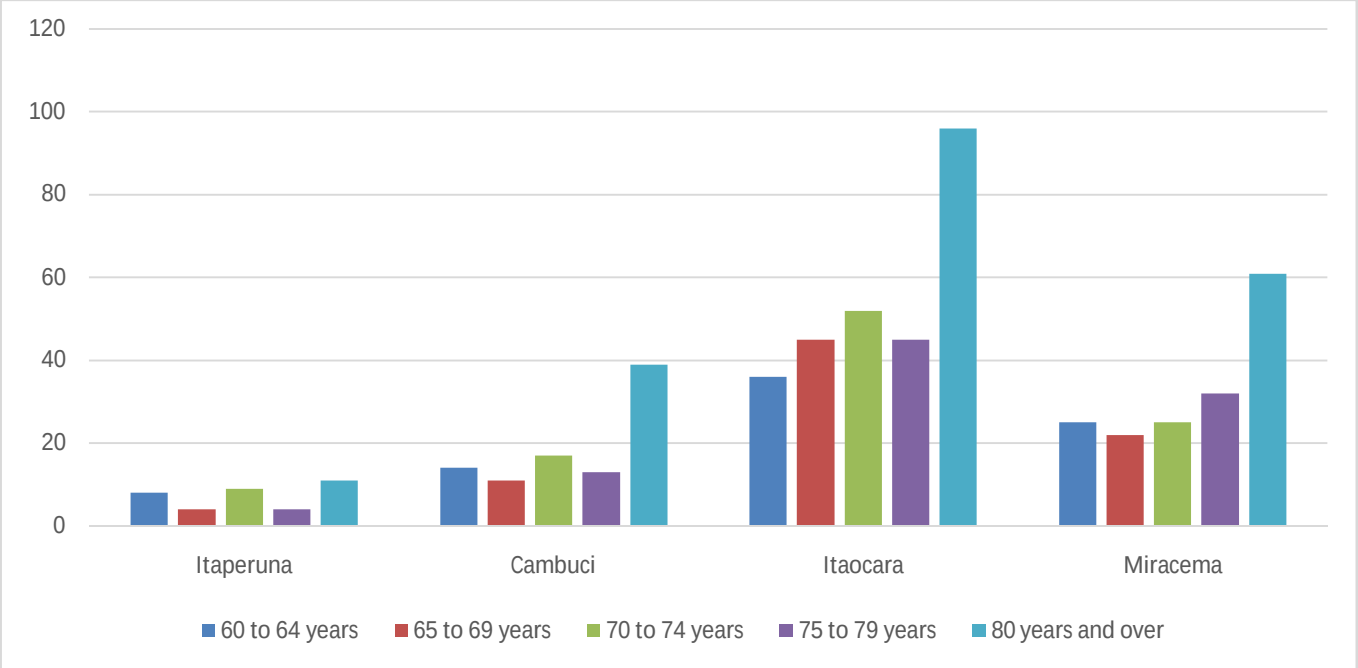

Fig. 5 – Distribution of total hospitalization records due to falls among the elderly population by age group in the Mesoregion of the Northwest of Rio de Janeiro in cities with the highest incidence of events from 2014 to 2023.

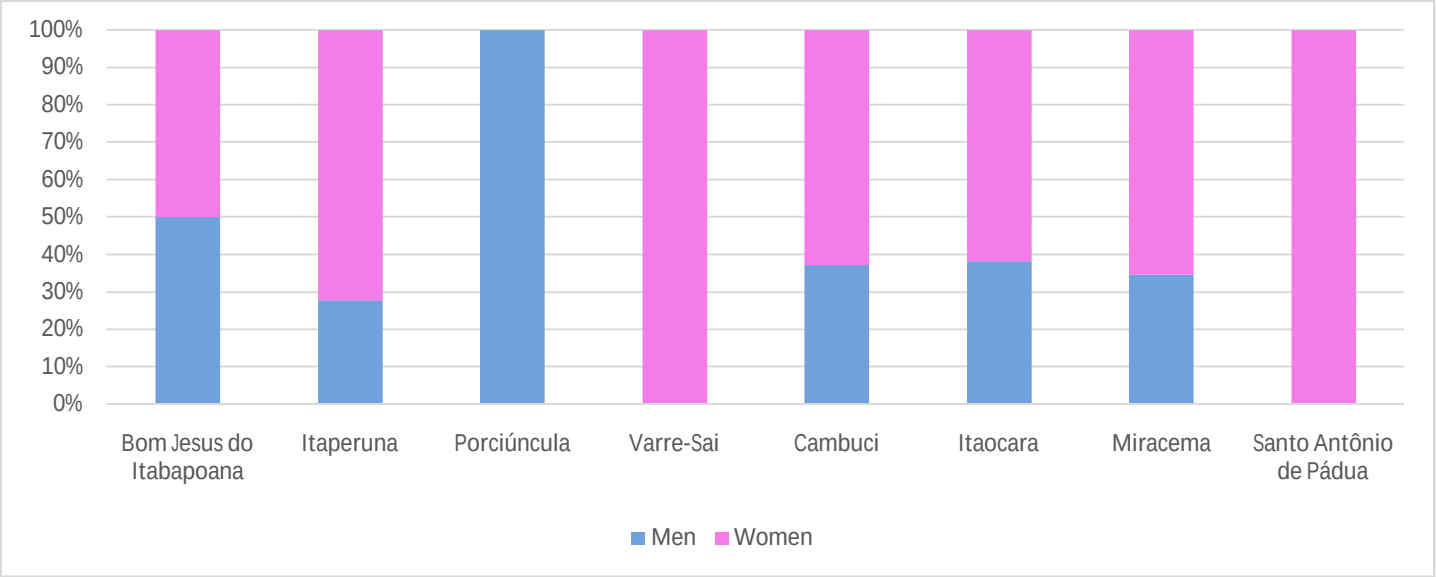

Fig. 6 - Distribution by gender of hospitalizations due to falls in the elderly population in the Mesoregion of the Northwest of Rio de Janeiro in cities with records of hospitalizations due to falls from 2014 to 2023.

Table1–Deaths resulting from hospitalizations due to falls among the elderly in the Mesoregion of the Northwest of Rio de Janeiro between 2014 and 2023.

City	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Overall
Aperibé	-	-	-	-	-	-	-	-	-	-	0
Bom Jesus do Itabapoana	-	-	-	-	1	-	-	-	-	-	1
Cambuci	-	1	-	1	1	-	-	-	-	-	3
Italva	-	-	-	-	-	-	-	-	-	-	0
Itaocara	1	1	1	1	-	2	1	-	-	-	8
Itaperuna	-	-	-	-	-	-	-	-	1	-	1
Laje do Muriaé	-	-	-	-	-	-	-	-	-	-	0
Miracema	-	-	-	-	-	-	2	1	2	2	7
Natividade	-	-	-	-	-	-	-	-	-	-	0
Porciúncula	-	-	-	-	-	-	-	-	-	-	0
Santo Antônio de Pádua	-	-	-	-	-	-	-	-	-	-	0
São José de Ubá	-	-	-	-	-	-	-	-	-	-	0
Varre-Sai	-	-	-	-	-	-	-	-	-	-	0
Overall	1	2	1	2	2	2	3	1	3	2	19

4. DISCUSSION

Demographic projections indicate that by 2050, the Brazilian population will be predominantly composed of elderly individuals [40,41,42]. In this context, the continuous increase in life expectancy raises concerns about one of the most common disabling events in this group: falls, which constitute a Public Health problem with significant social impact. Falls are among the most frequent domestic accidents and represent one of the main causes of accidental death in people over 65 years old [43,44,45,46,47,48]. In Brazil, the prevalence rate of falls in the elderly was estimated to be 27.6% by Siqueira et al. [49] in 2011. This rate is close to the global prevalence estimated by Salari et al. [50], at 26.5%. However, regions with a higher proportion of elderly people are more likely to have higher fall prevalence rates. Specific factors in these populations, such as a higher concentration of individuals with risk factors for falls, directly influence the prevalence rates [50]. Estimates indicate that at least half of these individuals experience multiple falls [34,30,51,52].

Falls among the elderly may be underreported due to various factors. Falls that do not result in serious injuries, such as fractures, are often neglected in medical records, contributing to underreporting [50,53]. Many elderly individuals who fall do not require hospitalization and are discharged, as although this type of accident raises concerns, it does not always result in serious injuries that require hospital admissions [54]. Another important reason is the absence of witnesses and retrograde amnesia, which complicates the accurate recollection and reporting of falls, especially when the fall is a consequence of syncope [55,56]. Additionally, many elderly individuals do not report falls to family or healthcare professionals unless they result in injuries, usually due to fear of losing independence or being admitted to institutions like nursing homes or care facilities [27]. This reluctance is exacerbated by the stigma associated with falls, leading to a significant number of unreported incidents [57]. Thus, while the prevalence or incidence rates of falls in the elderly may not accurately reflect the reality of these events, the determination of the incidence of care resulting from falls reported through health unit attendances tends to be more precise as it meets objective recording criteria and does not depend on patient-reported references.

Understanding the demographic composition of a population allows for targeted preventive measures and interventions to meet the specific needs of the elderly, potentially reducing the impact of falls on overall health and well-being. From this perspective, the increase in life expectancy is directly related to a demographic reconfiguration that tends to persist in the coming years, with repercussions on the increase in the number of falls among the elderly. The progressive increase in life expectancy is also expected to influence the prevalence rate of this type of accident and morbidity and mortality rates.As observed in our research and similar studies, health aggravations tend to be more pronounced among patients in the higher age groups. According to the demographic census of the Brazilian Institute of Geography and Statistics for 2022, the proportion of the Brazilian elderly population aged 60 years or older rose from 11.3% to 15.1% between 2012 and 2022. The aging index showed that in 2022 there are 55.2 people aged over 65 for every 100 children aged 0 to 14 years, whereas in 2010 this index was 30.7. The southeast region had the highest percentage of elderly people, accounting for 17% of the total population in this geographic area. The Mesoregion of the Northwest of Rio de Janeiro recorded a population increase of 2.06% between 2010 and 2022, reaching a total of 324,037 inhabitants, of which 20.69% are in the age group over 60 years, a higher index than that of the southeast region, the geographical area in which the Mesoregion of the Northwest of Rio de Janeiro is located [39]. This demographic peculiarity highlights the need for Public Health policies and actions aimed at mitigating the unique challenges faced by the elderly population in the mesoregion.

Mesoregions are geographical categories designed by the Brazilian Institute of Geography and Statistics (IBGE) to group cities sharing similar economic and social characteristics, enabling more effective regional planning and analysis, including Public Health planning and analyses [58,59]. The elderly populations in these geographical spaces, sharing the same characteristics, tend to exhibit similar health profiles influenced by a combination of relatively homogeneous socioeconomic, environmental, and lifestyle factors [60]. However, differences in access to healthcare services and the effectiveness of Public Health policies have direct impacts on the intensity and incidence of health issues among elderly populations in different areas within a mesoregion [61,62]. In the Mesoregion of the Northwest of Rio de Janeiro, the proportion of elderly individuals, divided by age groups over 60 years, is relatively homogeneous across all cities (Fig. 1). At the same time, the rates of hospitalizations due to falls among the elderly showed considerable differences and variable temporal trends for each city. Given the homogeneity in the proportion of age groups and socioeconomic, environmental, and lifestyle factors, intrinsic factors predisposing the elderly to falls should be common across the entire population. On the other hand, the asymmetry in the incidence rates and temporal trends of fall-related hospitalizations among the cities in the Mesoregion of the Northwest of Rio de Janeiro (Fig. 3) suggests significant regional variations related to extrinsic factors predisposing to falls as determinants of the different rates of this type of accident.

In the global analysis over the 10-year, 530 hospitalizations due to falls were recorded in the elderly population of the Mesoregion of the Northwest of Rio de Janeiro. The cities with the highest absolute number of cases in the period were, respectively: Itaocara (243/45.85%); Miracema (165/31.13%); and Cambuci (78/14.72%) (Fig. 2). In the projection of cases per 100,000 elderly individuals, the same cities remain in the lead: Itaocara (4478.44 cases/100,000 elderly), Miracema (3098.59 cases/100,000 elderly), and Cambuci (2285.38 cases/100,000 elderly) (Fig. 4). The projection of hospitalizations due to falls in the elderly in the Mesoregion of the Northwest of Rio de Janeiro was calculated at 790.2 per 100,000 elderly people. Considering the temporal course, significant variations in the incidence rates were observed (Fig. 3). Itaocara showed fluctuations, with a peak of 43 cases in 2018 and an average of 24.3 cases per year over the entire period. Miracema began recording fall-related hospitalizations in 2018, with seven cases, and showed an accelerated trend in hospitalization incidence, reaching a peak of 61 hospitalizations in 2022, and maintaining a high rate in 2023, with 24 fall-related hospitalizations. The average number of fall-related hospitalizations in the elderly in Miracema was calculated as 16.5 cases per year over the ten-year research period. Cambuci had an average of 7.8 cases per year, with a peak of 18 cases in 2018 and 2019, declined to one hospitalization in 2020, and had no new records in the following three years. The city of Cambuci established by municipal law in 2019 the "Policy for Elderly Care" updated in 2023, which creates public policy guidelines including regulations and lines of action in Public Health, preventive medicine, and

integrative therapies, accessibility in urban spaces and public transportation, maintenance of community centers and geriatric homes, and actions for the integration of the elderly into the community[63]. These guidelines were designed for joint implementation by various sectors of public administration under the coordination of a municipal council and specialists in elderly health. While the assessment of Public Health policy outcomes as a clear cause for the decrease in the incidence rates of fall-related hospitalizations in the elderly can only be determined through methodologies like STROBE or MOOSE [64,65], the adoption of actions based on these guidelines may have been responsible for the sharp decline in elderly hospitalization rates due to falls in the city of Cambuci.

Observing the lapse between 2014 and 2023, 2022 showed the highest number of hospitalizations among the entire studied period (Fig. 2), corresponding to the final phase of the COVID-19 pandemic. According to Lima et al. [66], hospitalization rates for falls among elderly patients in the Brazilian Public Health system increased in all regions of the country from 2000 to 2019, with a notable decrease in 2020, likely due to COVID-19 isolation measures. While a decline in hospitalization incidence among the elderly was observed in Itaocara and Cambuci in 2020, the same trend was not observed in Miracema, where hospitalization rates for falls among the elderly began to rise. The COVID-19 pandemic caused various changes in the health profiles of older age groups, subsequently affecting fall rates and hospitalizations. The pandemic restrictions, such as lockdowns and reduced access to preventive health services, led to decreased physical activity, a critical factor in the development of sarcopenia and frailty in the elderly [67,68,69,70,71]. During this period, the elderly experienced significant reductions in trunk muscle mass and overall physical function due to decreased outdoor movement, social isolation, or severe COVID-19 hospitalization [72,73,74]. Among individuals who develop moderate to severe forms of COVID-19, chronic inflammation resulting from acute SARS-CoV-2 infection exacerbates conditions like sarcopenia, functional decline, and cognitive impairments, further contributing to frailty and fall risk [72,75,76]. The return to daily activities after 2021, following a long period of reduced physical activity, might be one component responsible for the increased incidence of falls among the elderly and the severity of accidents, leading to a higher number of hospitalizations for such events in the cities of Miracema, Itaocara, and primarily, it is a plausible hypothesis for the peak of cases in 2022 in Itaperuna, the city with the highest number of elderly inhabitants in the mesoregion.

Regarding gender distribution, women accounted for 63.77% of the total elderly hospitalized because of falls in the Northwest of Rio de Janeiro (Fig 6). Various other studies in the current scientific literature also show that the incidence of falls among the elderly is notably higher in the female population in various regions worldwide [77,78,79,80]. Elderly women are more vulnerable to falls due to a combination of biological, psychological, and social factors. Biologically, women tend to have lower muscle strength and poorer balance performance than men, significantly increasing the risk of falling [81,82]. The female elderly population also shows poorer gait stability, with less stable walking patterns and lower body balance scores [83]. Another risk factor is that females are more likely to suffer from conditions such as sarcopenia [84,85,86], which further increases the risk of falls. Psychologically, current surveys indicate that women have higher levels of depression and more frequently report a fear of falling, which can lead to reduced physical activity and poorer gait quality, consequently increasing susceptibility to falls [7,9,87,88]. Mitigating this multiplicity of factors requires the application of targeted interventions to address the specific risks of the female gender [89,90]. Women are more likely to adhere to Public Health actions targeted at the elderly than men [91,92]. Elderly women tend to adopt positive health behaviours, particularly those related to prophylactic measures, better lifestyle practices, and self-care [93,94,95]. Implementing Public Health strategies aimed at elderly women has a direct impact on reducing fall rates and their adverse effects [96].DataSUS registry do not poit to male elderly that fell in Varre-Sai and Santo Antônio de Pádua. The small number of hospitalizations due to falls in these municipalities, combined with the reasons explaining the higher incidence of hospitalizations among women in such accidents, may account for this peculiarity.

It was found that the age group of 80 years and older accounted for the highest number of hospitalizations. Although this age group represents 15.65% of the elderly population aged 60 years and over, it accounted for 36.4% of hospitalizations due to falls in the Mesoregion of the Northwest of Rio de Janeiro (Fig. 4). Individuals in this age group are more susceptible to reduced bone density, muscle tone, and balance, making them more prone to falls and subsequent injuries, such as fractures and traumatic brain injuries [97,98]. Additionally, the prevalence of chronic conditions and multimorbidity, common in this demographic group, further increases the risk of falls and the severity of injuries sustained [99]. Cognitive impairments, including dementia, also significantly contribute to fall risk, as they affect judgment and physical coordination [100,101]. The use of multiple medications is another critical factor, and elderly individuals taking benzodiazepines or medications with anticholinergic properties that can cause muscle weakness, blurred vision, and mental confusion are at higher risk for fall events [102,103,104,105]. Falls in this age group are not only frequent but also recurrent, with approximately half of people over 85 experiencing multiple falls each year, leading to a higher likelihood of hospitalization [34]. Falls are the leading cause of hospitalizations among the elderly aged 80 and over [106]. In a study conducted in South Korea by Lee et al. [107], the highest hospitalization rate was observed in the 80-84 age group, representing 23% of total fall-related hospitalizations, followed by the 75-79 and 65-69 age groups with 22% and 21%, respectively. The incidence rates of fall-related hospitalizations in the Northwest Rio de Janeiro region (36.4%) are higher

than those found by Lee et al. (2023), indicating the need for adjustments in Public Health policies and actions by the cities in the region, especially due to the greater severity of morbidity and mortality rates associated with falls in this age group [34,99,106].The proportion of hospitalizations due to falls in the elderly was proportionally higher among those aged 80 or older in Cambuci, while the number of hospitalizations was higher in the municipalities of Itaocara and Miracema (Fig. 5). It is possible that intrinsic factors have a greater impact on the incidence of falls among the elderly in Cambuci, whereas the more equitable distribution of such events in Itaocara and Miracema suggests a greater importance of extrinsic factors.

The mortality rate among the elderly population in Brazil has shown a notable upward trajectory over the years [108,109,110]. Considering previous census data from the Brazilian Institute of Geography and Statistics, Monteiro et al. [109] evaluated the evolution of death cases among the elderly from 2000 to 2010. The results revealed a total of 72,234 deaths related to falls among individuals aged 60 years or older, representing 31.2% of all deaths, and mortality rates across all age groups increased from 29.7 per 100,000 elderly in 2010 to 44.7 per 100,000 elderly. It was observed that the number of deaths related to falls increased with advancing age. The period between 2000 and 2019 witnessed a total of 135,209 deaths attributed to falls in this demographic group, showing an annual increase of 5.45% [110]. Data from 1998 to 2015 revealed 54,673 reported deaths resulting from 1,192,829 hospitalizations related to falls among the elderly, yielding a fatality rate of 4.5% [111,112]. Our investigation examined 530 cases of hospitalization in the cities of the Mesoregion of the Northwest of Rio de Janeiro between 2014 and 2023, identifying 19 elderly individuals who succumbed to the consequences of falls during the hospitalization period, corresponding to a mortality rate of 3.5% (Table 1), which is comparatively lower than the national average. The overall trend across all cities shows fluctuations, with no clear pattern of increase or decrease year by year. Although there is an observable difference in mortality rates over time in the Mesoregion of the Northwest of Rio de Janeiro—8 deaths between 2013 and 2018, and 11 deaths between 2019 and 2023—a statistical inference might be considered biased due to the small sample size evaluated.

Research based on DataSUS data presents known limitations: incomplete records, lack of standardization in data collection, lack of integration between causes of hospitalization and prognoses, lack of historical context of the records, methodological restrictions inherent to the data recording process, limitations of secondary data, lack of differentiation between incidents and prevalent cases, exclusion of hospitalizations not belonging to the Unified Health System, and absence of clinical information [113,114,115,116]. Furthermore, it is emphasized that ecological studies such as this, using secondary data, do not allow access to individual information, considering the population group as a whole and not the particular differences of each individual [117]. Personalized data are essential for understanding how isolated, sequential, or comorbid fall events are related to the severity of injuries and influence epidemiology.Although such limitations of the database reduce the accuracy and depth of analysis, DataSUS is considered a reliable source for health research in Brazil and is essential for the formulation of Public Health policies and actions because of the objectivity and quality of the consolidated data. The results of the epidemiological diagnosis of hospitalizations due to falls among the elderly in the Mesoregion of the Northwest of Rio de Janeiro corroborates the perception of health professionals working in the region regarding the incidence of this type of accident and the aspects involved in the need for patient hospitalization.

5. CONCLUSION

Although the currently available data may be considered insufficient for a more in-depth analysis, this preliminary research aims to alert public health authorities in the mesoregion to the imperative for a detailed investigation employing the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) methodology. This study should encompass comprehensive data collection and analysis, necessitating proactive measures to elucidate specific public health challenges and identify potentially effective policies and interventions.

Epidemiological analysis of the dataset compiled by DataSUS revealed significant variations in hospitalization rates attributable to falls among the elderly in different cities of the studied mesoregion. Additionally, the distinct temporal trends observed in these rates and the evident asymmetry in their incidence patterns strongly suggest that extrinsic factors play a crucial role in driving these disparities. The notable prevalence of hospitalizations due to falls among the elderly highlights the need to monitor and understand the reasons behind these fluctuations, especially considering that the increasing trends witnessed in some cities such as Miracema and Itaocara contrast sharply with a marked decline in Cambuci over the last three years of the study. Given that populations within a mesoregion share inherent risks from intrinsic factors for falls, differences in the emphasis on Public Health measures in different cities may be responsible for the regional disparities in such accidents among the elderly.

The breakdown of incidences by gender and age group reflected trends observed in similar research, with women and individuals over 80 years old being disproportionately affected by falls. Public Health interventions must prioritize these demographic groups to mitigate the number of hospitalizations resulting from fall-related injuries. In terms of mortality rates, the prevalence was 3.5%, which, although comparatively lower than the national average, remains a significant concern that warrants further attention and targeted interventions.

The epidemiological analysis indicates the need for more incisive Public Health interventions in the cities of Miracema and Itaocara. In the Mesoregion of the Northwest of Rio de Janeiro, some cities have achieved success, while others still face challenges in preventing the extrinsic causes that predispose the elderly to falls requiring hospitalization. The experience of the municipality of Cambuci, implementing the "Policy for Elderly Care", which creates public policy guidelines including regulations and lines of action in Public Health, preventive medicine, and integrative therapies, accessibility in urban spaces and public transportation, maintenance of community centers and geriatric homes, and actions for the integration of the elderly into the community, should be replicated in Miracema and Itaocarato reduce the hospitalization rates due to falls in the elderly. We believe that sharing the experiences of the Municipal Health Departments, with cooperation and coordination in terms of resources, joint planning of regional Public Health actions, and collaborative governance, could be strategies to prevent falls in the elderly population and consequently lead to a reduction in hospitalizations from such events.

Disclaimer (Artificial intelligence)

Authors hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

References

1. Peng K, Tian M, Andersen M, Zhang J, Liu Y, Wang Q, et al. Incidence, risk factors and economic burden of fall-related injuries in older Chinese people: a systematic review. Inj Prev. 2019 Feb;25(1):4–12.

2. Sadaqa M, Debes WA, Németh Z, Bera-Baka Z, Vachtler-Szepesi M, Nácziné Földes L, et al. Multicomponent Exercise Intervention for Preventing Falls and Improving Physical Functioning in Older Nursing Home Residents: A Single-Blinded Pilot Randomised Controlled Trial. JCM. 2024 Mar 10;13(6):1577.

3. Saleh SHA, Aly WW, Saber HG, Aziz BKA. Falls amongst elderly attending the outpatient's clinic in the Geriatric medicine, in Ain Shams University Hospitals: Prevalence and risk factors. The Egyptian Journal of Geriatrics and Gerontology. 2024 Mar 1;11(1):12–24.

4. Topka W, Kwiatkowska MM, Skierkowska N, Prylińska M, Gajos W. Falls among the elderly. J Educ Health Sport. 2020 Sep 23;10(9):614–8.

5. Martins R, Carvalho N, Batista S, Dinis A. Falls in Elderly: Study of the Prevalence and Associated Factors. EJDEVELOP. 2022 May 12;2(3):12–7.

6. Lin FF, Yang WY, Zhou JX, Cao LY, Huang LL. Retrospective Investigation and Research on Fall Events Among Hospitalized Patients in the Rehabilitation Department. RMHP. 2024 Apr;Volume 17:1069–78.

7. Miri S, Norasteh AA. Fear of falling, quality of life, and daily functional activity of elderly women with and without a history of falling: a cross-sectional study. Annals of Medicine & Surgery. 2024 May;86(5):2619–25.

8. Saxena S, Zutrauen S, McFaull SR. Assault-related traumatic brain injury hospitalizations in Canada from 2010 to 2021: rates, trends and comorbidity. Inj Epidemiol. 2024 Feb 7;11(1):4.

9. Tavan H, Azadi A. The frequency of fall, fear of fall and its related factors among Iranian elderly: A systematic review and meta-analysis. International Journal of Africa Nursing Sciences. 2024;20:100660.

10. Asavamongkolkul A, Adulkasem N, Chotiyarnwong P, Vanitcharoenkul E, Chandhanayingyong C, Laohaprasitiporn P, et al. Prevalence of osteoporosis, sarcopenia, and high falls risk in healthy community-dwelling Thai older adults: a nationwide cross-sectional study. JBMR Plus. 2024 Feb 15;8(2):ziad020.

11. Lee A, McArthur C, Ioannidis G, Duque G, Adachi JD, Griffith LE, et al. Associations between Osteosarcopenia and Falls, Fractures, and Frailty in Older Adults: Results From the Canadian Longitudinal Study on Aging (CLSA). Journal of the American Medical Directors Association. 2024 Jan;25(1):167-176.e6.

12. Nakayama M, Furuya T, Inoue E, Tanaka E, Ikari K, Yamanaka H, et al. Factors associated with sarcopenia in Japanese patients with rheumatoid arthritis: results from the IORRA cohort study. Clin Rheumatol. 2024 Jan;43(1):521–6.

13. Ferrari P, Cristina S, Moça T. Falls in Elderly with Plantar Changes. BJMMR. 2014 Jan 10;4(34):5421–30.

14. Gialanella B, Comini L, Prometti P, Vanoglio F, Santoro R. Effects of Motor Rehabilitation on Balance and Functional Activities in Elderly Patients with Peripheral Neuropathy and Recurrent Falls. Life. 2023 Apr 20;13(4):1059.

15. Firoz A, Azharuddin M, Usmani M, Parveen S, Sehgal CA, Noohu MM. Comparison of Effects of Balance Training Exercise and Gaze Stability Exercises on Balance and Postural Control in Elderly With Fall Risk: A Randomized Controlled Trial. Physical & Occupational Therapy In Geriatrics. 2024 Feb 26;1–17.

16. Hyland S, Hawke LJ, Taylor NF. Benign paroxysmal positional vertigo without dizziness is common in people presenting to falls clinics. Disability and Rehabilitation. 2024 Feb 24;1–6.

17. Biercewicz M. Falls as a Common Problem in Elderly People with Neurological Diseases. PNIN. 2022 Dec 1;11(3):137–41.

18. Li Z, Jiang X, Yang M, Pan Y. Association between falls and nonmotor symptoms in patients with Parkinson's disease. Journal of Clinical Neuroscience. 2023 Dec;118:143–6.

19. Kyvetos A, Kyritsi E, Vrettos I, Voukelatou P, Manoli AD, Papadopoulou E, et al. Association Between Chronic Diseases and Frailty in a Sample of Older Greek Inpatients. Cureus [Internet]. 2024 Apr 18 [cited 2024 Jun 3]; Available from: https://www.cureus.com/articles/245738-association-between-chronic-diseases-and-frailty-in-a-sample-of-older-greek-inpatients

20. Zhang S, Xu W, Zhu Y, Tian E, Kong W. Impaired Multisensory Integration Predisposes the Elderly People to Fall: A Systematic Review. Front Neurosci. 2020 Apr 28;14:411.

21. Kong HH, Shin K, Won CW. Association of Dual Sensory Impairment with Declining Physical Function in Community-Dwelling Older Adults. IJERPH. 2023 Feb 17;20(4):3546.

22. Puthiyamadam MR, Charlton JA, Hak S, Minio F, Panchmatia J. Falls and Death in Dual Sensory Impairment. Am Fam Physician. 2023 Jan;107(1):83–4.

23. Erbaş DH, Çınar F, Aslan FE. Elderly patients and falls: a systematic review and meta-analysis. Aging Clin Exp Res. 2021 Nov;33(11):2953–66.

24. Lee FS, Sararaks S, Yau WK, Ang ZY, Jailani AS, Abd Karim Z, et al. Fall determinants in hospitalised older patients: a nested case control design - incidence, extrinsic and intrinsic risk in Malaysia. BMC Geriatr. 2022 Mar 3;22(1):179.

25. Lewis SR, Griffin XL. Preventing falls in older people: the evidence for environmental interventions and why history matters. Cochrane Database of Systematic Reviews [Internet]. 2023 Mar 10 [cited 2024 Jun 3];2023(3). Available from: http://doi.wiley.com/10.1002/14651858.ED000162

26. Gao Y, Wang N, Liu Y, Liu N. Effectiveness of virtual reality in preventing falls in non-disabled older adults: A meta-analysis and systematic review. Geriatric Nursing. 2024 Jul;58:15–25.

27. Ang G, Low S, How C. Approach to falls among the elderly in the community. smedj. 2020 Mar;61(3):116–21.

28. Vaishya R, Vaish A. Falls in Older Adults are Serious. IJOO. 2020 Feb;54(1):69–74.

29. Poh FJX, Shorey S. A Literature Review of Factors Influencing Injurious Falls. Clin Nurs Res. 2020 Mar;29(3):141–8.

30. Kobayashi K, Ando K, Nakashima H, Suzuki Y, Nagao Y, Imagama S. Relationship between use of sleep medication and accidental falls during hospitalization [Internet]. Nagoya University Graduate School of Medicine, School of Medicine; 2021 [cited 2024 May 21]. Available from: https://doi.org/10.18999/nagjms.83.4.851

31. Khatib SE, Malham CB, Andrieu S, Strumia M, Cestac P, Salameh P. Fall risk factors among poly-medicated older Lebanese patients in primary care settings: a secondary cross-sectional analysis of the "MGPIDP-L project." BMC Geriatr. 2024 Apr 10;24(1):327.

32. Ríos-Fraustro C, Galván-Plata ME, Gómez-Galicia DL, Giraldo-Rodríguez L, Agudelo-Botero M, Mino-León D. Intrinsic and extrinsic factors associated with falls in older adults: a case-control study in Mexico. GMM. 2023 Mar 31;157(2):6702.

33. Gawrońska K, Lorkowski J. Falls, Aging and Public Health – a Literature Review. OrtopediaTraumatologiaRehabilitacja. 2020 Dec 31;22(6):397–408.

34. Giovannini S, Brau F, Galluzzo V, Santagada DA, Loreti C, Biscotti L, et al. Falls among Older Adults: Screening, Identification, Rehabilitation, and Management. Applied Sciences. 2022 Aug 8;12(15):7934.

35. . Fonseca APD, Tombini Filho OF, Krüger RM. Costs to the Unified Health System resulting from hospitalizations for falls in the elderly in a municipality in the west of Santa Catarina. RSD. 2022 Dec 17;11(16):e566111638456.

36. . Kwon J, Squires H, Young T. Incorporating frailty to address the key challenges to geriatric economic evaluation. BMC Geriatr. 2024 Feb 14;24(1):155.

37. Sanchez CMC. Prevalence of risk of falls in a permanent geriatric stay. MOJGG. 2023 Jul 13;8(3):53–7.

38. Ministry of Health. DataSUS. Tabnet. Brasília, DF: Ministry of Health, 2022

39. . Brazilian Institute of Geography and Statistics. Demographic Census 2022. DF: IBGE, 2024.

40. Morais ACBDS, Silva JDFD, Silva KCRD, Farias RDS, Nobre SEFR, Marchi SM. Challenges and Perspectives for population aging: a Brazil-Argentina comparative analysis. HealSoc2024 Feb 25;4(01):288–300.

41. Rodrigues PVM, Fruhauf DLS, Silva DAOD, Costa LS, Nazzaro ADCB, Souza Afonso Da Silva I, et al. Morbidade hospitalar por fratura de fêmur em idosos no Brasil: uma análise descritiva. Braz J Implantol Health Sci. 2024 Feb 21;6(2):1823–44.

42. Sobrinho LCDSL, Mendes ALDAC, Lima AAMR, Vieira FC, Mendes MSODC, Cavalcanti TAS, et al. Envelhecimento populacional e feminização da velhice no contexto da atenção à saúde do idoso no Brasil. Braz J Hea Rev. 2024 Mar 26;7(2):e68369.

43. Carpenter CR, Cameron A, Ganz DA, Liu S. Older Adult Falls in Emergency Medicine. Clinics in Geriatric Medicine. 2019 May;35(2):205–19.

44. Casati A, Granieri S, Cimbanassi S, Reitano E, Chiara O. Falls from Height. Analysis of Predictors of Death in a Single-Center Retrospective Study. JCM. 2020 Sep 30;9(10):3175.

45. Shankar KN, Li A. Older Adult Falls in Emergency Medicine, 2023 Update. Clinics in Geriatric Medicine. 2023 Nov;39(4):503–18.

46. Kakara R, Bergen G, Burns E, Stevens M. Nonfatal and Fatal Falls Among Adults Aged ≥65 Years — United States, 2020–2021. MMWR Morb Mortal Wkly Rep. 2023 Sep 1;72(35):938–43.

47. Deng R, Li B, Qin M, Yu X, Sun J, Jiao F, et al. The characteristics and risk factors of fatal falls among adults aged 60 and above in Southwest China. Sci Rep. 2024 Mar 25;14(1):7020.

48. Otani H, Shimoinaba J, Kashiwagi H, Morita T, Maeda I, Yokomichi N, et al. Prevalence of falls in the last weeks of life and relationship between falls, independence, and quality of dying: A secondary analysis of a large prospective cohort study. 2024 [cited 2024 May 21]. Available from: http://medrxiv.org/lookup/doi/10.1101/2024.02.12.24302685

49. Siqueira FV, Facchini LA, Silveira DSD, Piccini RX, Tomasi E, Thumé E, et al. Prevalence of falls in elderly in Brazil: a countrywide analysis. Cad SaúdePública. 2011 Sep;27(9):1819–26.

50. Salari N, Darvishi N, Ahmadipanah M, Shohaimi S, Mohammadi M. Global prevalence of falls in the older adults: a comprehensive systematic review and meta-analysis. J Orthop Surg Res. 2022 Jun 28;17(1):334.

51. Choi MK, Lee MS. The Factors Associated with Falls and Multiple Falls Among the Korean Elderly. 융합연구학회지. 2022;6(3):431–45.

52. Singh RR, Maurya P. Visual impairment and falls among older adults and elderly: evidence from longitudinal study of ageing in India. BMC Public Health. 2022 Dec 12;22(1):2324.

53. Nguyen-Michel V, Bornand A, Balathazar A, Kinugawa K, Lâm X, Piette F, et al. Fall related to epileptic seizures in the elderly. Epileptic Disorders. 2015 Sep;17(3):287–91.

54. Nowicki G, Rzońca P, Naylor K, Rudnicka-Drożak E, Młynarska M, Prystupa A, et al. Fall as a cause of hospitalization in the Emergency Department in a population of people over 65 years of age. J Pre Clin Clin Res. 2015 Dec 16;9(2):115–9.

55. Rafanelli M, Mossello E, Testa GD, Ungar A. Unexplained falls in the elderly. Minerva Med 2022 May;113(2). Available from: https://www.minervamedica.it/index2.php?show=R10Y2022N02A0263

56. Forsdyke D. Cryptic evidence on underreporting of mRNA vaccine-induced cardiomyositis in the elderly: a need to modify antihypertensive therapy QUEIOS 2023 Fev;9(2):1–11. Available from: https://www.qeios.com/read/MLP1TN.2

57. Hoffman GJ, Ha J, Alexander NB, Langa KM, Tinetti M, Min LC. Underreporting of Fall Injuries of Older Adults: Implications for Wellness Visit Fall Risk Screening. J American Geriatrics Society. 2018 Jul;66(6):1195–200.

58. Alves RFS, Boccolini PDMM, Baroni LR, Relvas-Brandt LDA, Gritz RDAJ, Boccolini CS. Brazilian spatial, demographic, and socioeconomic data from 1996 to 2020. BMC Res Notes. 2022 Dec;15(1):159.

59. Siqueira TS, Silva JRS, Souza MDR, Leite DCF, Edwards T, Martins-Filho PR, et al. Spatial clusters, social determinants of health and risk of maternal mortality by COVID-19 in Brazil: a national population-based ecological study. The Lancet Regional Health - Americas. 2021 Nov;3:100076.

60. Dermatis Z, Lazakidou A, Anastasiou A, Liargovas P. Analyzing Socio-Economic and Geographical Factors that Affect the Health of the Elderly. J Knowl Econ. 2021 Dec;12(4):1925–48.

61. Almasi A, Saeidi S, Zangeneh A, Khezeli M, Salimi Y, Soofi M, et al. Geographical Access of the Elderly to Health Care Centers During a 20-Year Period (1996–2016): a Case Study of Kermanshah, Iran. J GenIntern Med 2021 Oct;36(10):3249–51.

62. Fan C, Ouyang W, Tian L, Song Y, Miao W. Elderly Health Inequality in China and its Determinants: A Geographical Perspective. IJERPH. 2019 Aug 16;16(16):2953.

63. Política de atendimento ao Conselho Municipal do Idoso e o Fundo Municipal do idoso, Law n.º 530, 16 oct 2023 (Cambuci) (Brasil). Avaiable at: https://camaracambuci.rj.gov.br/arquivos/legislacao/530_2023_1060leino5302023.pdf.

64. Atkinson JA, Page A, Wells R, Milat A, Wilson A. A modelling tool for policy analysis to support the design of efficient and effective policy responses for complex Public Health problems. Implementation Sci. 2015 Dec;10(1):26.

65. Jensen PH. Experiments and evaluation of public policies: Methods, implementation, and challenges. Aust J Public Adm. 2020 Jun;79(2):259–68.

66. Lima JDS, Quadros DVD, Silva SLCD, Tavares JP, Pai DD. Custos das autorizações de internação hospitalar por quedas de idosos no Sistema Único de Saúde, Brasil, 2000-2020: um estudo descritivo. Epidemiol Serv Saúde. 2022;31(1):e2021603.

67. Gautam K, Krishnan K S, Kumar K V, Nayak MM. Trends in frailty and its associated factors in the community dwelling elderly Indian population during the COVID-19 pandemic: A prospective analytical study. F1000Res. 2023 Jun 26;11:311.

68. König M, Gollasch M, Komleva Y. Frailty after COVID -19: The wave after? Aging Medicine. 2023 Sep;6(3):307–16.

69. Murayama A, Higuchi D, Saida K, Tanaka S, Shinohara T. Fall Risk Prediction for Community-Dwelling Older Adults: Analysis of Assessment Scale and Evaluation Items without Actual Measurement. IJERPH. 2024 Feb 14;21(2):224.

70. Silva FMDA, Safons MP. Risk of frailty and associated factors among community older adults during the COVID-19 pandemic. Cad Pedagógico. 2024 Feb 9;21(2):e2673.

71. Cardoso ÉK, Pereira FDS, Bidart TDS, Pereira EB, Schreiber BG, Da Rosa LHT. Onfluence of social isolation caused by COVID-19 in elderly people hospitalization associated with falls in an emergency hospital. Brazilian J Physic Ther. 2024 Apr;28:100734

72. Massari MC, Bimonte VM, Falcioni L, Moretti A, Baldari C, Iolascon G, et al. Nutritional and physical activity issues in frailty syndrome during the COVID-19 pandemic. Therapeutic Advances in Musculoskeletal. 2023 Jan;15:1759720X2311526.

73. Son B, Imoto T, Inoue T, Nishimura T, Lyu W, Tanaka T, et al. Different reversibility of skeletal muscle mass and strength in elderly Japanese women after the first wave of COVID-19. JCSM Rapid Communications. 2023 Jan;6(1):26–32.

74. Figueiredo TEND, Zopelari LMP, Heubel AD, Pires Di Lorenzo VA. Physical performance, musclw's strength and endurance in adults and elderly people without previous disabilities at hospital discharge for COVID-19.. Braz J Physic Ther. 2024 Apr;28:100997.

75. Merchant RA, Chan YH, Anbarasan D, Vellas B. Association of intrinsic capacity with functional ability, sarcopenia and systemic inflammation in pre-frail older adults. Front Med. 2024 Mar 6;11:1374197.

76. Castro GSD, Gama LR, Ramos AF, Gatti Da Silva G, Teixeira AADS, Cunha-Neto E, et al. Post-COVID-19 condition: systemic inflammation and low functional exercise capacity. Front Nutr. 2024 Mar 14;11:1295026.

77. Dias LZ. Comment: "Prevalence of falls in elderly people: a population-based study." Rev Assoc Med Bras. 2019 Nov;65(11):1404–1404.

78. Dochviri T, Chikhladze N, Pitskhelauri N, Dochviri T. The fall in the geriatric population: epidemiology and prevention.JECM 2022; 1:1–5. Available from: https://journals.4science.ge/index.php/jecm/article/view/727

79. Dent E, Dalla Via J, Bozanich T, Hoogendijk EO, Gebre AK, Smith C, et al. Frailty increases the long-term risk for fall and fracture-related hospitalizations and all-cause mortality in community-dwelling older women. Journal of Bone and Mineral Research. 2024 Apr 19;39(3):222–30.

80. Liu T, Li F, Li Y, Li J, Chen L, Yang Z, et al. Epidemiological characteristics and factors influencing hospitalization burden among trauma patients: a retrospective analysis. Eur J Trauma Emerg Surg. 2024 Apr;50(2):425–37.

81. Özer FF, Akın S, Soysal T, Şentürk Durmuş N, Gökçekuyu BM. Falls in Older Women and Men: Associated Factors and Sarcopenia. Eur J GeriatricGeront. 2023 Apr;5(2):124–131.

82. Suh M, Kim DH, Cho I, Ham OK. Age and Gender Differences in Fall-Related Factors Affecting Community-Dwelling Older Adults. Journal of Nursing Research. 2023 Apr;31(2):e270.

83. Ji J, Sun CL, Wildes TM, Freedman RA, Magnuson A, O'Connor T, et al. Falls and hospitalization during chemotherapy in older women with early breast cancer. JCO. 2023 Jun 1;41(16_suppl):12035–12035.

84. Nascimento MDM, Gouveia ÉR, Gouveia BR, Marques A, França C, Marconcin P, et al. Sex Differences in Falls: The Mediating Role of Gait Stability Ratio and Body Balance in Vulnerable Older Adults. JCM. 2023 Jan 5;12(2):450.

85. Felipe TL, Grili PPDF, Vidigal CV, Albergaria BH, Cruz GFD, Marques-Rocha JL, et al. Skeletal muscle mass obtained by anthropometric equation and presence of sarcopenia in postmenopausal women. Revista Brasileira de Ginecologia e Obstetrícia / RBGO Gynecol Obstetrics. 2024 Mar 14;46:e-rbgo9.

86. Prell T, Grimm A, Axer H. Uncovering sarcopenia and frailty in older adults by using muscle ultrasound—A narrative review. Front Med. 2024 May 17;11:1333205.

87. Agarkov NM, Gurko TS, Lev IV. The social and medical aspects of falls in elderly and senile age under eyesight deficiency. ProblSotsialnoi Gig Zdravookhranenniiailstor Med 2023 May;31(3). Available from: https://pubmed.ncbi.nlm.nih.gov/37427513/

88. Gomaa S, Swartz K, Chapman AE, Zhan T, Wen KY. Risk factors for falls and fear of falling among older patients with cancer. JCO. 2023 Jun 1;41(16_suppl):e24032–e24032.

89. Samkova IA, Larina VN, Kozyrev SE, Runihina NK. The Relationship of the Risk of Falls with the Features of Cognitive Function and Emotional Status (Fear of Falls) in Older People. Arhiv" vnutrennejmediciny. 2022 Nov 30;12(6):459–66.

90. Kim KM, Lui LY, Cummings SR. Recent fall and high imminent risk of fracture in older men and women. Age and Ageing. 2022 Jun 1;51(6):afac141.

91. Barbosa DS, Neto JECM, Filho JF. The relationship of public policies focused to the elderly and their effectiveness toward the population. FIEP. 2019 Jan 1;89(I):121–4.

92. Saintrain MVDL, Pinheiro CPO, Amorim RFD, Santos ZMDSA, Santos FDS, Frota MA, et al. Gender Differences in Health Self-Perception in Older Adults in Primary Health Care in Brazil. European Journal of Natural Sciences and Medicine. 2022 Oct 1;5(2):1–16.

93. . Oliveira FA, Sousa FS, Cavalcante SL, Couto ARM, Almeida ANSD, Castelo Branco MFC. Health education activities carried out with a group of elderly women to promote health self-care. Extension: R Extension Electro. 2018 Apr 23;15(28):137–50.

94. Cardoso JDC, Azevedo RCDS, Reiners AAO, Andrade ACDS. Health beliefs and adherence of the elderly to fall prevention measures: a quasi-experimental study. Rev Bras Enferm. 2022;75(suppl 4):e20201190.

95. Kuska M, Nowak MA, Żukowska H, Pasek M, Szark-Eckardt M. Health Behavior of People Over 60 and Their Dependence on Socio-Economic Factors. RASP. 2022 Jan 30;10(1):1–20.

96. Vilpunaho T, Karinkanta S, Sievänen H, Kopra J, Kröger H, Rikkonen T. Predictive ability of a self-rated fall risk assessment tool in community-dwelling older women. Aging Clin Exp Res. 2023 May 5;35(6):1205–12.

97. Trevisan C, Welmer AK, Curreri C, Noale M, Maggi S, Sergi G. The impact of falls on the need for hospital care in older people: results from the Pro.V.A. study. JGG. 2023 Jan;1–9.

98. Zhou J, Liu B, Ye H, Duan JP. A prospective cohort study on the association between new falls and balancing ability among older adults over 80 years who are independent. Experimental Gerontology. 2023 Sep;180:112259.

99. Skains RM, Zhang Y, Osborne JD, O'Leary T, Fowler ME, Markland A, et al. Hospital-associated disability due to avoidable hospitalizations among older adults. J American Geriatrics Society. 2023 May;71(5):1395–405.

100. Pitskhelauri N, Dochviri T, Akhobadze K, Chkhaberidze N, Chikhladze N, Kereselidze M, et al. Falls among elderly: evidence from hospital settings in Georgia. European Journal of Public Health. 2022 Oct 21;32(Supplement_3):ckac131.419.

101. Rico CLV, Quirarte NHG, Ortiz LGC, Hidalgo HC, Valderrama SMC, Rayas LF. Factors associated with the deterioration of intrinsic capacity in older people in Mexico and Colombia. Ann Geriatr Med Res [Internet]. 2024 Mar 13 [cited 2024 Jun 3]; Available from: http://e-agmr.org/journal/view.php?doi=10.4235/agmr.23.0182

102. Estell M, Muntz R, Scott G, Jones S, Veld M. 397 Fall hospitalisations and deaths in Australians aged 65 and over, 2019–20. In: Abstracts [Internet]. BMJ Publishing Group Ltd; 2022 [cited 2024 Jun 3]. p. A60.1-A60. Available from: https://injuryprevention.bmj.com/lookup/doi/10.1136/injuryprev-2022-safety2022.178

103. Xu XJ, Tan MP. Anticholinergics and falls in older adults. Expert Review of Clinical Pharmacology. 2022 Mar 4;15(3):285–94.

104. Fukada H, Nojiri S, Uematsu T, Nishizaki Y. Association between Central Nervous System Drugs and Femoral Fracture Risk in Japanese Individuals ≥80 Years Old: A Case-crossover Study. Intern Med. 2024;3224–23.

105. Barbosa EM, Silva ESCD, Andrade HCQ, Peixoto ICDS, Rodrigues TDA, Guimarães MCM, et al. O uso de benzodiazepínicos em idosos associados aos acidentes por quedas. RSD. 2024 Jan 6;13(1):e3113144712.

106. Schousboe JT, Langsetmo L, Fink HA, Kado DM, Cauley JA, Taylor BC, et al. Balancing fracture risk versus risk of mortality before fracture among women aged 80 years or older. J American Geriatrics Society. 2024 May;72(5):1396–407.

107. Lee S, Paek KW, Park NS, Kim MK, Jeon S. Association between location of fall and mortality in hospitalized elderly patients for falls. kjhep. 2023 Mar 31;40(1):89–101.

108. Antes DL, Schneider IJC, d'Orsi E. Mortality caused by accidental falls among the elderly: a time series analysis. Rev bras geriatrgerontol. 2015 Dec;18(4):769–78.

109. Monteiro YCM, Vieira MADS, Vitorino PVDO, Queiroz SJD, Policena GM, Souza ACSE. Trend of fall-related mortality among the elderly. Rev esc enferm USP. 2021;55:e20200069.

110. Gonçalves ICM, Freitas RF, Aquino EC, Carneiro JA, Lessa ADC. Mortality trend from falls in Brazilian older adults from 2000 to 2019. Rev bras epidemiol. 2022;25:e220031.

111. Stolt LROG, Kolisch DV, Tanaka C, Cardoso MRA, Schmitt ACB. Increase in fall-related hospitalization, mortality, and lethality among older adults in Brazil. Rev SaúdePública. 2020 Aug 11;54:76.

112. Silva JMM, Da Silva Freitas JLG, Nóbrega JCL, Medeiros JB, Simões RFM, Olinda R, et al. Regional differences regarding the occurrence of falls and associated factors in two populations of Brazilian longevous people. BMC Geriatr. 2022 Dec 2;22(1):931.

113. Antunes PDSL, Libório PR, Shimoda GM, Pivetta LGA, Parreira JG, Assef JC. Trauma Quality Indicators' usage limitations in severe trauma patients. Rev Col Bras Cir. 2021;48:e20202769.

114. Souza VD, Paiva Filho LHA. Diseases of the Osteomuscular System and connective tissue: Use of Datasus to evaluate the epidemiological pattern in the state of Paraná. RSD. 2023 Aug 17;12(8):e7312842185.

115. Marques MDA, Mendonça MA. Epidemiological analysis of hospitalizations for femoral fractures in the elderly in the city of Rio de Janeiro. REASE. 2023 Feb 28;9(2):471–82.

116. . Viana SW, Faleiro MD, Mendes ALF, Torquato AC, Tavares CPO, Feres B, et al. Limitations of using the DataSUS database as a primary source of data in surgery research: a scoping review. Rev Col Bras Cir. 2023;50:e20233545.

117. Roni G, Castelo Branco Araújo A, Maud H, Noll M, Macedo De Souza Jr H, Ferraz Campos M, et al. Mortality from Stroke in Pará, Brazilian Amazon: a Joinpoint Analysis. jhgd. 2024 Apr 11;34(1):68–78.

118. Rijal , S. (2022) "Polypharmacy in Elderly People: A Simple Review", Journal of Pharmaceutical Research International, 34(64), pp. 40–49. doi: 10.9734/jpri/2022/v34i647293.

119. Nopmanee, T., C. Sukrom, U. Teerachai, D. Jirapong, and K. Nirutchara. 2021. "The Factors Related to Death of Trauma Preventable Death Patients in Rajavithi Hospital". Asian Journal of Medicine and Health 19 (5):39-44. https://doi.org/10.9734/ajmah/2021/v19i530327.

120. Sadigh S, Reimers A, Andersson R, Laflamme L. Falls and fall-related injuries among the elderly: a survey of residential-care facilities in a Swedish municipality. Journal of community health. 2004 Apr;29:129-40.

121.