Original Research Article

EPIDEMIOLOGICAL ASSESSMENT OF HOSPITALIZATIONS DUE TO FALLS AMONG THE ELDERLY IN THE MESOREGION OF THE NORTWEST 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 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 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]. 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.

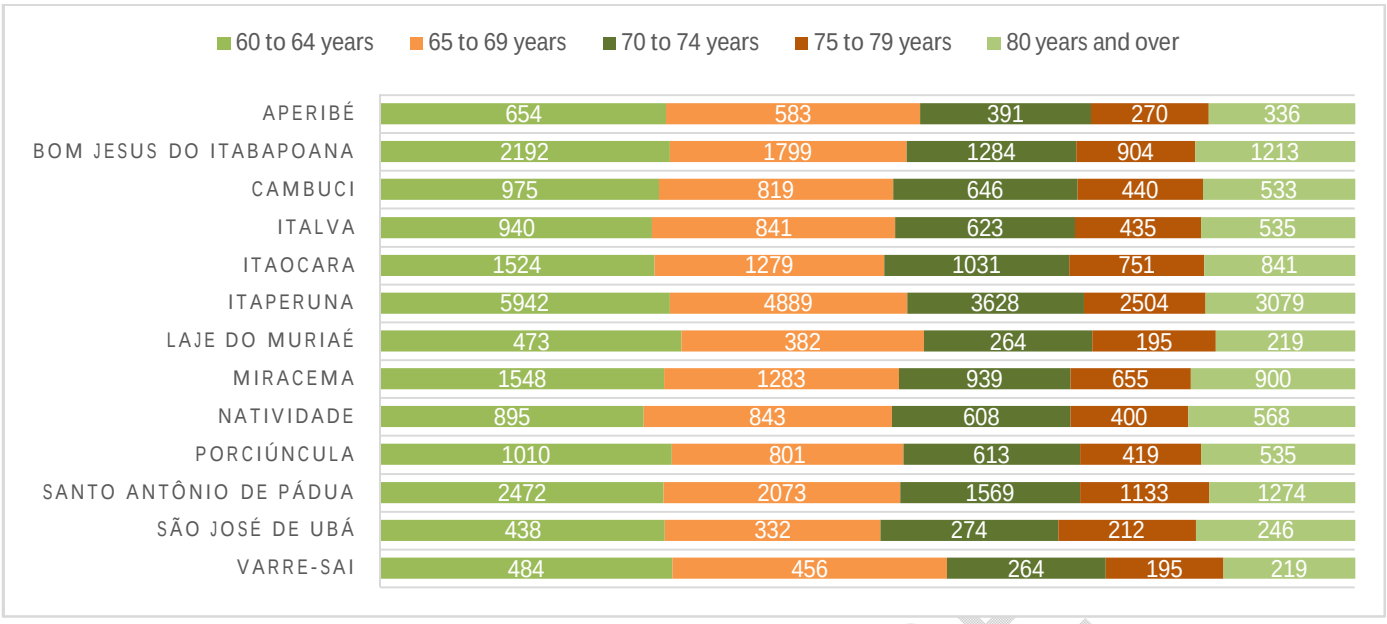

Fig. 1 – Proportional distribution of the total elderly population in the Mesoregion of the Northwest of Rio de Janeiro according to age group.

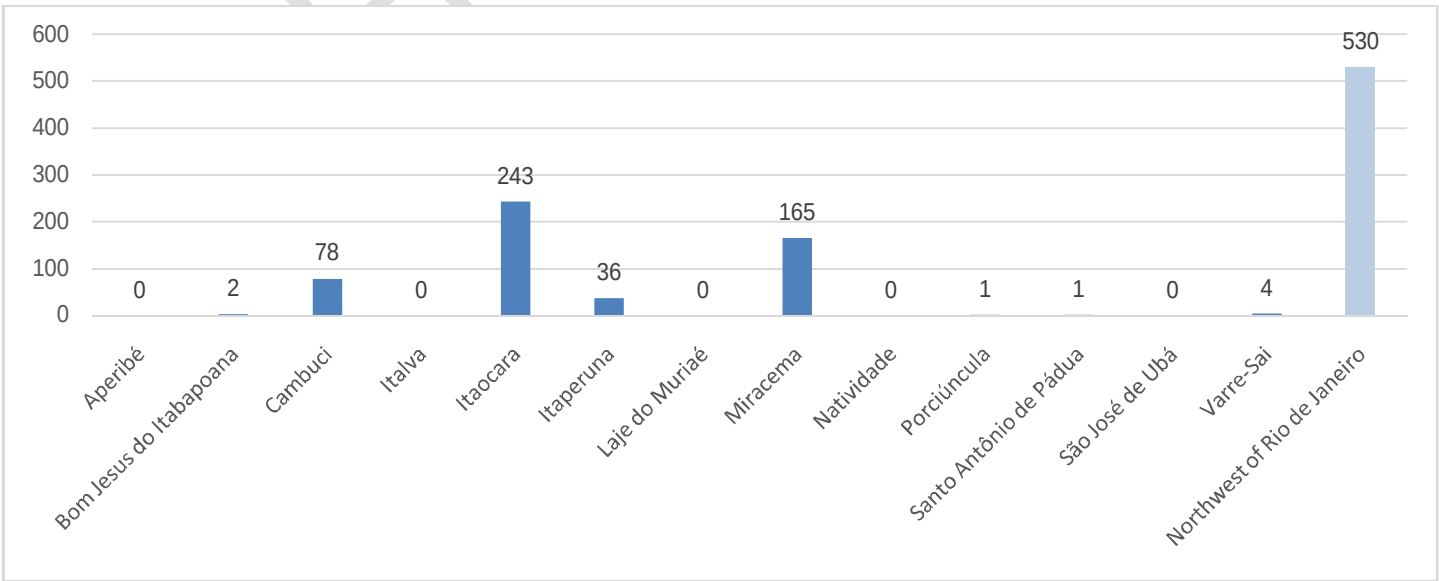

Fig. 2 – Absolute number of hospitalizations due to falls in the elderly population of the Mesoregion of the Northwest of Rio de Janeiro by city between 2014 and 2023.

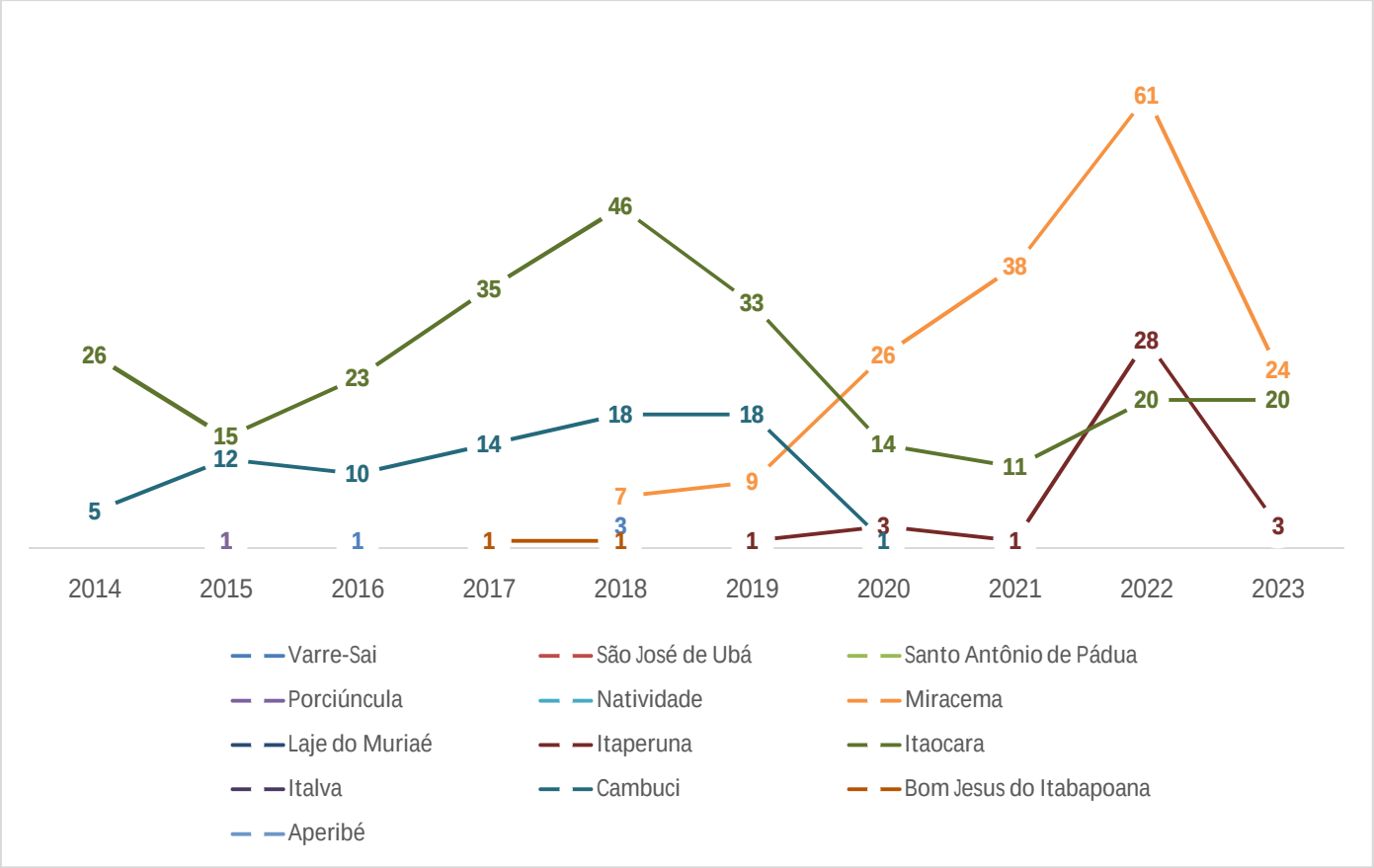

Fig. 3 – Temporal distribution of hospitalizations due to falls in the elderly population of the Mesoregion of the Northwest of Rio de Janeiro by city between 2014 and 2023.

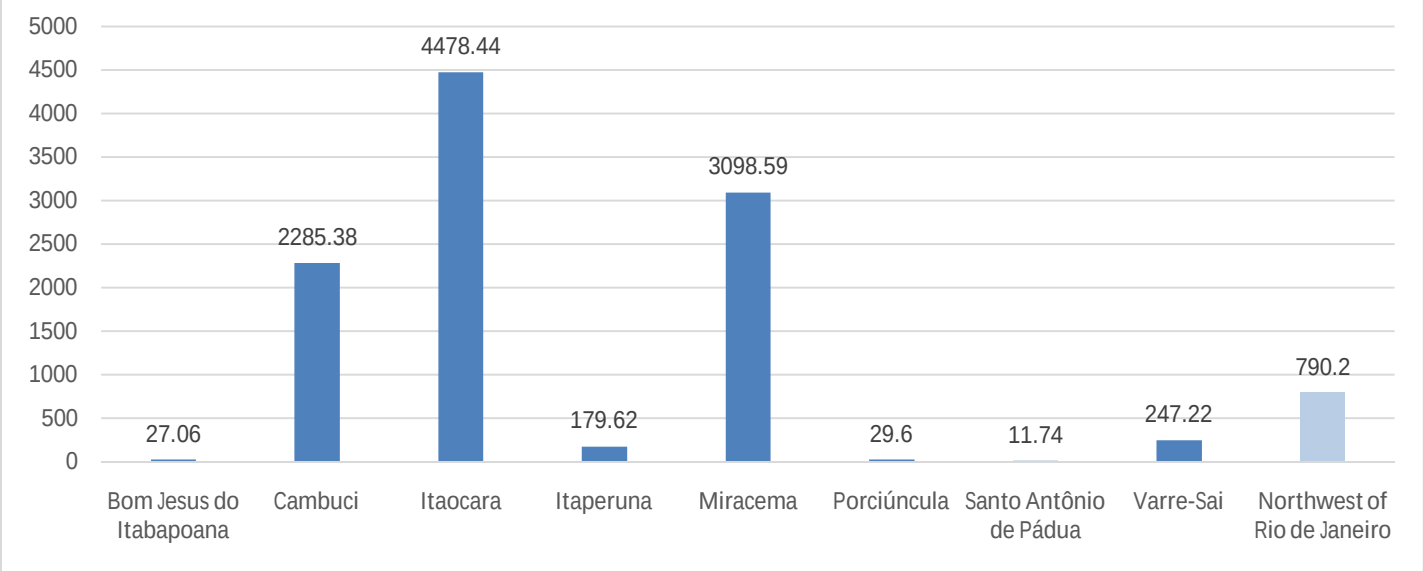

Fig. 4 – Projection of the number of hospitalizations due to falls per 100,000 elderly individuals in the Mesoregion of the Northwest of Rio de Janeiro in cities with records of hospitalizations due to falls between 2014 and 2023.

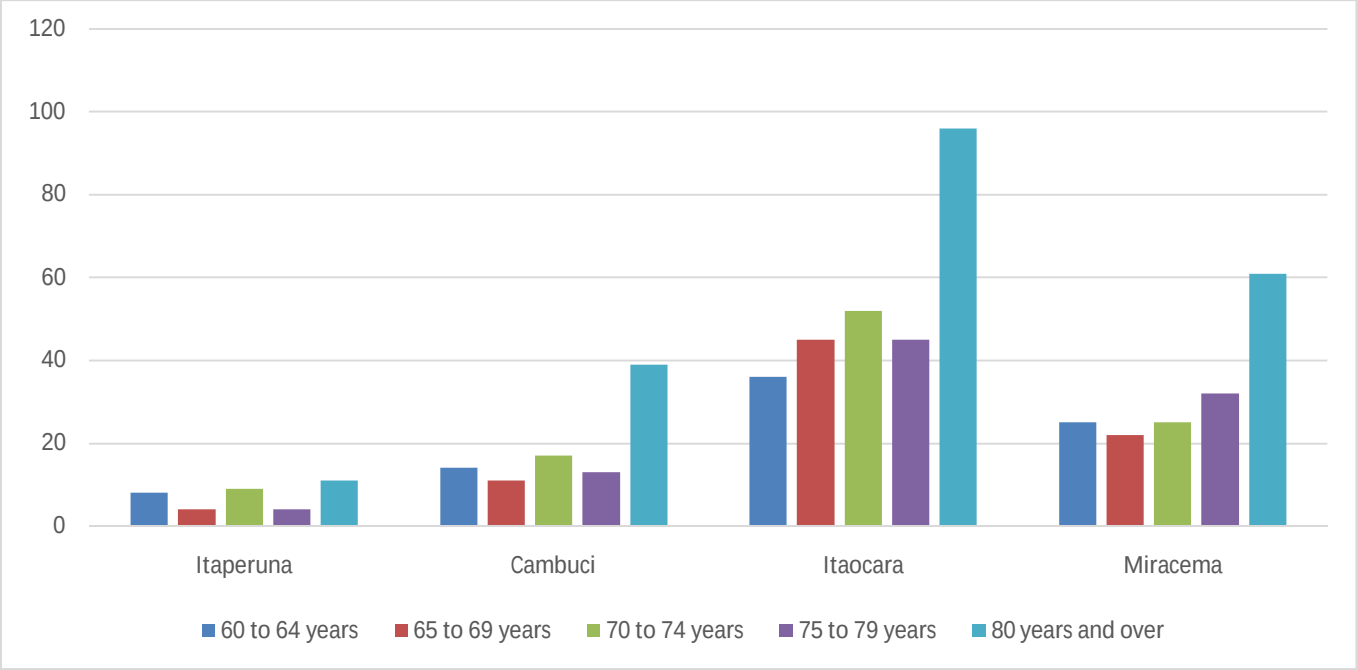

Fig. 5 – Distribution of total hospitalization records due to falls among the elderly population by age group in the Mesoregion of the Northwest of Rio de Janeiro in cities with the highest incidence of events from 2014 to 2023.

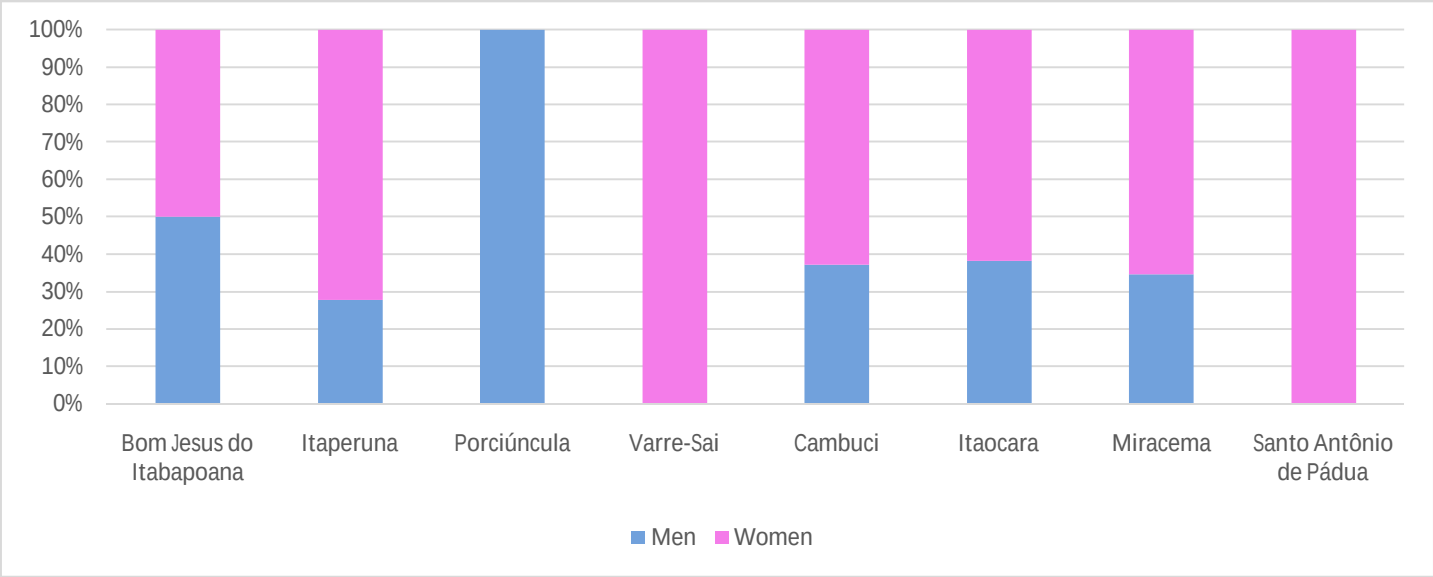

Fig. 6 - Distribution by gender of hospitalizations due to falls in the elderly population in the Mesoregion of the Northwest of Rio de Janeiro in cities with records of hospitalizations due to falls from 2014 to 2023.

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]. 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].

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 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]. 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

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. 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.

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