Revista ARACÊ
ISSN: 2358-2472

HOSPITALIZATIONS FOR IRON DEFICIENCY ANEMIA IN THE ELDERLY IN BRAZIL BEFORE, DURING, AND AFTER THE COVID-19 PANDEMIC

https://doi.org/10.56238/arev6n3-275

Submitted on: 20/10/2024 **Publication date:** 20/11/2024

Daniel Sávio Braga de Freitas[1], Larissa Lopes Teixeira Fagundes[2], Luiza Rodrigues Ramos Rocha[3], Maria Isabel Maia Rocha[4], Sara Oliveira Queiroz[5], Arissa Nami Utsunomya Saraiva[6] and Karina Andrade de Prince[7]

ABSTRACT

This research aimed to analyze hospitalizations for iron deficiency anemia in the elderly, before, during, and after the Covid-19 pandemic. This is an ecological time series study, using data from the Hospital Information System of the Unified Health System (SIH/SUS), using Prais-Winsten regression. In the period from 2017 to 2023, 42,805 hospitalizations for iron deficiency anemia in the elderly were reported in Brazil. The annual coefficient increased in the country during and after the Covid-19 pandemic, from 21 cases per 100 thousand elderly people in 2017 to 24 per 100 thousand in 2023, showing a stationary trend (-0.5%; p=0.176). The analysis of the hospitalization coefficient and the trend by region was increasing in the North (1.5%; p = 0.040) and Central-West (1.1%; p = 0.049) regions, and stationary in the other regions. Hospitalization and mortality rates were higher in males (22.8 to 26.0 cases/100,000; 7.4 to 6.58%), in the age group of 80 years or older (53.6 to

[1] Graduating in Medicine
Centro Universitário FIPMOC – UNIFIPMOC, Brazil
E-mail: daniel.freitas@aluno.unifipmoc.edu.br
ORCID: https://orcid.org/0009- 0001-8177-3106
[2] Medical Student
Centro Universitário FIPMOC – UNIFIPMOC, Brazil
E-mail: larissaltf@yahoo.com.br
ORCID: https://orcid.org/0009-0000-4963-2533
[3] Medical Student
Centro Universitário FIPMOC – UNIFIPMOC, Brazil
E-mail: luiza.rodriguesramos.rochaa@gmail.com
ORCID: https://orcid.org/0009-0001- 5488-234X
[4] Medical Student
Centro Universitário FIPMOC – UNIFIPMOC, Brazil
E-mail: mariaisabelmrocha@gmail.com
ORCID: https://orcid.org/0009-0004-3429-4964
[5] Medical Student
Centro Universitário FIPMOC – UNIFIPMOC, Brazil
E-mail: sahqueiroz@icloud.com
ORCID: https://orcid.org/0009-0008-6514-3009
[6] Medical Student
Centro Universitário FIPMOC – UNIFIPMOC, Brazil
E-mail: arissautsu@hotmail.com
ORCID: https://orcid.org/0009-0002-1351-3035
[7] Dr. in Biosciences and Biotechnology
Centro Universitário FIPMOC – UNIFIPMOC, Brazil
E-mail: karinaprince0708@gmail.com
ORCID: https://orcid.org/0000-0001-8231-852X

Revista ARACÊ
ISSN: 2358-2472

60.0 cases/100,000; 8.09 to 7.58%), and in emergency care (19.3 to 21.8/100,000; 6.96 to 6.54%). It is possible to conclude that hospitalizations for iron deficiency anemia in the elderly in the country increased, especially during and after the covid-19 pandemic, predominating among men over 80 years of age. Thus, health restrictions, reduced income, viral infection, low intake of iron-rich foods, and difficulties in accessing health services during the Covid-19 pandemic may have contributed to this increase. Thus, the importance of public policies aimed at the health, well-being and quality of life of the elderly population is emphasized, in order to reduce the rates of hospitalizations and mortality in the country.

Keywords: Iron deficiency anemia, COVID-19, Elderly.

Revista ARACÊ
ISSN: 2358-2472

INTRODUCTION

According to the Statute of the Elderly (Law No. 10,741/2003), in Brazil, individuals aged 60 and over are categorized as elderly. In the past, reaching old age was reserved only for a privileged minority, however, with the advancement of technology and medicine, it is a common achievement both in Brazil and in less developed countries. In the country, the phenomenon of population aging, which has become increasingly prominent in the last century, was more expressive, especially in comparison with the global trend (Barros; Goldbaum, 2018). In 2018, Brazil had 19.2 million people aged 65 and over, representing about 9% of the population. In addition, projections indicate that by 2060 this number will increase to 58.2 million, equivalent to 25.5% of the population (IBGE, 2018).

Anemia is characterized by a decrease in the number of red blood cells or a reduced ability of these cells to carry oxygen through hemoglobin to meet physiological demands. It is a common condition among the elderly and poses a significant public health challenge due to its clinical ramifications and impact on quality of life. This disease represents a widespread public health challenge, increasing the risk of morbidity and mortality. Complications of morbidity related to chronic anemia range from reduced productivity to cognitive difficulties and greater vulnerability to infections, contributing significantly to substantial economic losses (Machado *et al*., 2019).

The Covid-19 pandemic, triggered by the SARS-CoV-2 virus, has resulted in a set of global public health challenges, with effects that exceed the disease itself. Measures to control the spread of the pathology, especially between 2020 and 2022, negatively affected the nutritional quality and habits of the population, resulting in an increase in the number of cases of iron deficiency anemia (Taghinijad *et al*; 2022).

Covid-19 infection causes an inflammatory response, which interferes with iron metabolism, by the accumulation of iron in ferritin in macrophages and the increase in hepcidin, and as a consequence reduces iron release and absorption, respectively. In the face of Covid-19 cases, iron deficiency anemia, together with alterations in iron homeostasis and hyperinflammation, represent significant risk factors for the development of serious complications, such as lung injuries, respiratory failure, and worse clinical outcome with ARDS - acute respiratory distress syndrome (Bellmann-Weiler *et al*; 2020).

This research offers a contribution to the understanding of the factors that influence hospitalizations for iron deficiency anemia in the elderly, allowing the characterization of patterns of incidence and regionalization. In addition, it reveals the need for preventive

Revista ARACÊ
ISSN: 2358-2472

actions, with pharmacological and nutritional approaches and measures that enable the continuous monitoring of the health of the elderly, especially in regions of high social vulnerability, where access and resources to health are limited.

METHODOLOGY

This is an ecological time series study. The research universe was secondary data, obtained from the SUS Hospital Information System (SIH/SUS), regarding hospitalizations for iron deficiency anemia in the elderly in Brazil, according to the regions of the country, in the period from 2017 to 2023.

Brazil is characterized by a vast territorial extension located in South America and has an area of 8,510,417.771 km², considered the fifth largest territorial extension in the world. The country has an estimated population of 203,062,512 inhabitants, with a demographic density of 23.86 inhabitants/km². The country is divided into 27 federative units, 26 states and the Federal District, and is divided into five regions, with their respective populations: North (8.54%), Northeast (26.91%), Midwest (8.02%), Southeast (41.78%) and South (14.74%) (IBGE, 2023).

Data were collected in August and September 2024, through the SUS Hospital Information System (SIH/SUS), widely available by the SUS Department of Informatics (DATASUS), at the electronic address (http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sih/cnv/niuf.def) (Brasil, 2024).

The SIH/SUS is a database in the public domain, standing out as an important tool for epidemiological analysis of hospitalizations. This system, based on the hospital admission authorization form (AIH), provides sociodemographic and clinical data, which make it possible to evaluate the epidemiological behavior and financial costs of the services owned and contracted to the SUS.

Hospitalizations were selected based on the tenth version of the International Classification of Diseases (ICD 10), which groups in chapter III the diagnosis related to iron deficiency anemia (D50).

The variables studied were sociodemographic (gender, age group (≥ 60 years) and color/race) and clinical variables (number of hospital admissions by region and per year of care, character of care, average hospital stay, mortality rate, average expenditure and total expenditure of hospitalizations).

Revista ARACÊ
ISSN: 2358-2472

The data regarding the population estimate were obtained from the Brazilian Institute of Geography and Statistics (IBGE) and were consulted in the institute's database of statistical tables (IBGE, 2024). The population estimate counted by the Census was used as the denominator for the years 2017 to 2023 of the series.

For the Brazilian level, the hospitalization coefficient was calculated as the ratio between the total number of hospitalizations per annual elderly population. For the analysis stratified by length of hospitalization (elective and urgent) and outcome of hospitalization (discharge and death), the ratio between the number of hospitalizations in each stratum and the elderly population for each year was considered. Hospitalization coefficients were adjusted per 100 thousand inhabitants.

The in-hospital mortality coefficient was calculated by dividing the number of in-hospital deaths due to iron deficiency anemia by the number of hospitalizations of these individuals in the same year, multiplied by 100.

For the analysis of temporal trends, the generalized linear regression model was used using the Prais-Winsten method, with robust variance, with the hospitalization and hospital mortality coefficients being the predictor variables (Y), and time (year) the outcome variable (X). Based on the robust variance, the coefficients of annual variation of the measures were quantified, the respective 95% confidence intervals (95%CI) were estimated, and the p-value was adequate for statistical inference. The trends in the hospitalization and mortality coefficients were interpreted as: increasing ($p < 0.05$ and positive change), decreasing ($p < 0.05$ and negative change) or stationary ($p > 0.05$) (Antunes; Cardoso, 2015).

The tools developed by Datasus – TabWin and TabNet – were used for data tabulation and descriptive analysis, and the Microsoft Office Excel 2023 program for the construction of graphs and tables, in addition to the data analysis and statistics software Stata version 17.0.

The research, as it collects secondary data in the public domain, made available electronically by the Ministry of Health and, as there is confidentiality about the personal information of the patients involved, does not require appreciation and approval by the Research Ethics Committee, according to Resolution No. 466/2012 of the National Health Council (Brasil, 2012).

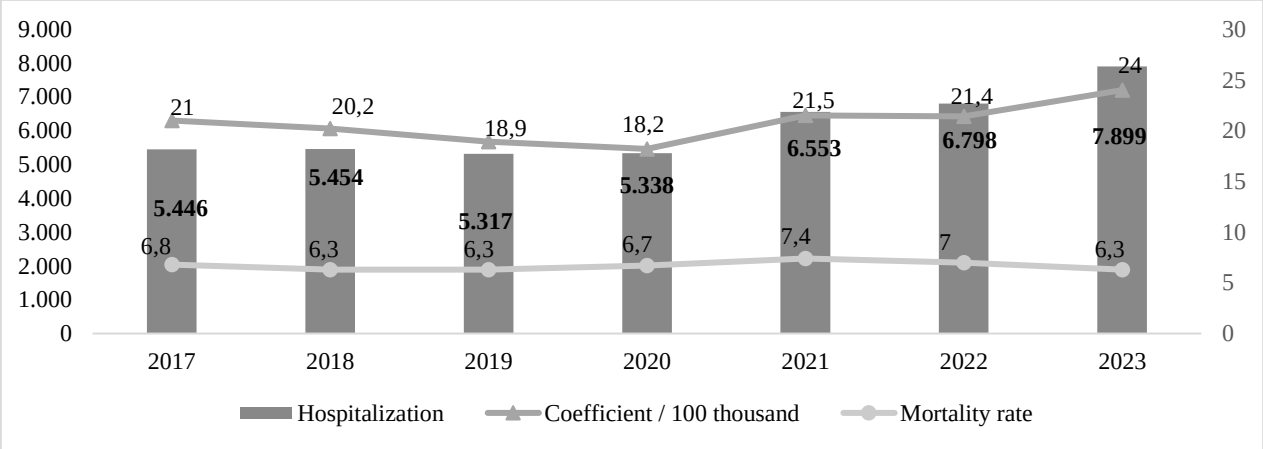
Revista ARACÊ
ISSN: 2358-2472

RESULTS

From January 2017 to December 2023, 42,805 cases of hospitalization for iron deficiency anemia in the elderly were recorded in Brazil. The number of hospitalizations has increased in recent years (5.7%), especially during and after the Covid-19 pandemic (Figure 1).

The annual hospitalization rate in the country also increased during and after the covid-19 pandemic, from 21 cases per 100 thousand elderly people in 2017 to 24 per 100 thousand in 2023. However, the mean annual coefficient of variation was stationary, with a mean annual variation of -0.5% (p = 0.176) (Figure 1).

Figure 1. Number of hospitalizations, coefficient per 100 thousand, and mortality rate due to iron deficiency anemia in the elderly in Brazil, 2017 to 2023.



Source: Ministry of Health - SUS Hospital Information System (SIH/SUS)

The analysis of the hospitalization coefficient and the trend by region was increasing in the North (annual change = 1.5%; p = 0.040) and Midwest (annual change = 1.1%; p = 0.049) regions. However, it was stationary in the Northeast (annual change = 0.7%; p = 0.135), Southeast (annual change = 0.6; p = 0.134) and South (annual change = -0.6%; p = 0.090). The South region had the highest hospitalization coefficients, before and during the covid-19 pandemic, and after the pandemic, the North region showed the highest hospitalization coefficient (Figure 2 and Table 1).

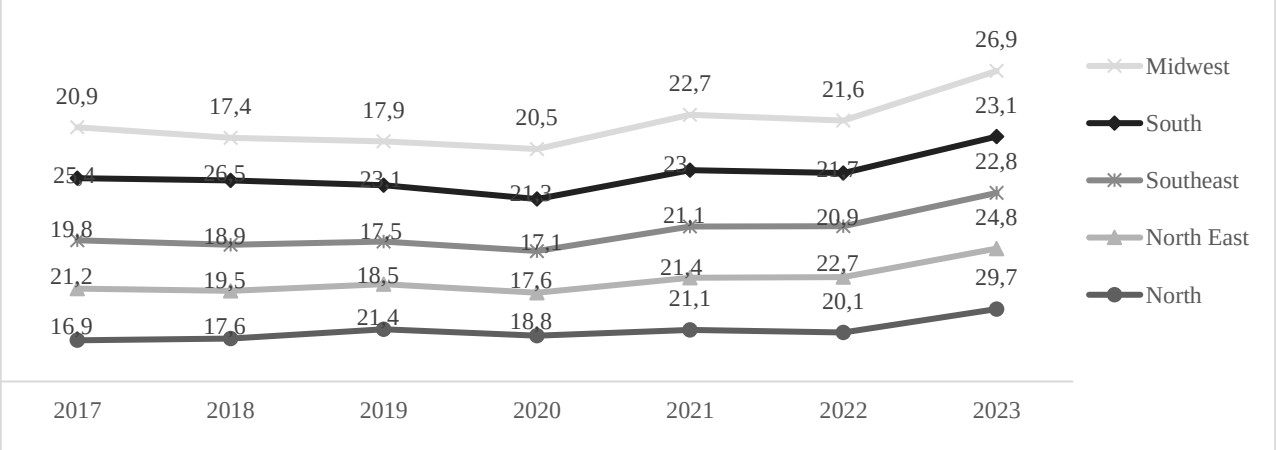
Revista ARACÊ
ISSN: 2358-2472

Table 1. Coefficient of hospitalization for iron deficiency anemia in the elderly and trend analysis by sex, age group, nature of hospitalization, hospitalization outcome, before, during, and after the Covid-19 pandemic. Brazil, 2017 to 2023.

	Pre-Pandemic			Pandemic	Post-Pandemic Trend Analysis for the period from 2017 to 2023						
Variables	2017	2018	2019	2020	2021	2022	2023	Coefficient annual change	IC95%[b]	p	Tendency
Admissions											
North	16,9	17,6	21,4	18,8	21,1	20,1	29,7	1,5	0,1 a 3,0	0,040	Crescent
Northeast	21,2	19,5	18,5	17,6	21,4	22,7	24,8	0,7	-0,3 a 1,8	0,135	Stationary
Southeast	19,8	18,9	17,5	17,1	21,1	20,9	22,8	0,6	-0,3 a 1,5	0,134	Stationary
On	25,4	26,5	23,1	21,3	23,0	21,7	23,1	-0,6	-1,3 a 0,1	0,090	Stationary
Central-West	20,9	17,4	17,9	20,5	22,7	21,6	26,9	1,1	0,0 a 2,2	0,049	Crescent
Brazil	21,0	20,2	18,9	18,2	21,5	21,4	24,0	0,5	-0,3 a 1,3	0,176	Stationary
Mortality Rate											
North	5,2	6,4	6,9	4,5	6,1	6,7	4,5	-0,1	- 0,6 a 0,5	0,705	Stationary
Northeast	8,3	8,4	7,9	8,5	9,2	7,2	7,2	-0,1	-0,5 a 0,2	0,315	Stationary
Southeast	5,9	5,6	6,2	6,8	7,5	7,5	7,0	0,3	0,1 a 0,5	0,010	Crescent
On	7,4	5,4	5,2	6,0	6,4	6,1	4,1	-0,3	-0,7 a 0,2	0,205	Stationary
Central-West	6,3	6,2	4,2	3,8	3,7	3,7	4,8	-0,3	-0,8 a 0,1	0,118	Stationary
Brazil	6,8	6,3	6,3	6,7	7,4	7,0	6,3	0,0	-0,2 a 0,3	0,685	Stationary

Source. Ministry of Health – Hospital Information System of the SUS (SIH / SUS).

Figure 2. Evolution of the coefficient of hospitalization for iron deficiency anemia in the elderly (per 100 thousand inhabitants), according to the regions of Brazil, 2017 to 2023.



Source. Ministry of Health – Hospital Information System of the SUS (SIH / SUS).

Revista ARACÊ
ISSN: 2358-2472

Analyzing the hospitalization rate according to the profile of the patients, it was higher in males (22.8 to 26.0 cases/100,000), in the age group of 80 years or older (53.6 to 60.0 cases/100,000), in the emergency situation (19.3 to 21.8/100,000) and among patients who progressed to cure (19.1 to 21.9/100,000), with annual coefficients of variation of 0.5%, 1.1%, 0.4% and 0.4%, respectively, and a stationary trend (Table 2).

Table 2. Coefficient of hospitalization for iron deficiency anemia in the elderly and trend analysis by sex, age group, nature of hospitalization, outcome, before, during, and after the Covid-19 pandemic. Brazil, 2017 to 2023.

	Pre-Pandemic			Pandemic			Post-Pandemic		Trend analysis for the period 2017 to 2023		
Variables	2017	2018	2019	2020	2021	2022	2023	variation annual	95%[b]		p Trend
Sex											
Male	22,8	22,1	20,7	19,8	23,1	22,6	26,0	0,5	-0,4 a 1,3	0,236	Stationary
Female	19,5	18,7	17,4	17,0	20,2	20,5	22,3	0,5	-0,2 a 1,3	0,140	Stationary
Age group											
60-69	11,0	10,7	9,6	10,0	11,6	11,3	12,9	0,3	-0,1 a 0,8	0,130	Stationary
70-79	24,8	24,9	22,2	20,7	21,1	25,9	27,6	0,5	-0,6 a 1,6	0,318	Stationary
≥80	53,6	48,7	49,3	45,8	53,2	52,0	60,0	1,1	-1,0 a 3,1	0,247	Stationary
Character Hospitalization											
Elective	1,2	1,2	0,9	0,8	1,2	1,3	1,6	0,1	-0,1 a 0,2	0,235	Stationary
Urgency	19,3	18,5	17,6	17,0	19,8	19,6	21,8	0,4	-0,3 a 1,1	0,178	Stationary
Hospitalization Outcome											
Loud	19,1	18,5	17,3	16,6	19,4	19,4	21,9	0,4	-0,3 a 1,2	0,190	Stationary
Death	1,4	1,2	1,2	1,2	1,5	1,5	1,5	0,0	-0,0 a 0,1	0,212	Stationary

Source. Ministry of Health – Hospital Information System of the SUS (SIH / SUS).

Analyzing the mortality rate due to iron deficiency anemia among the elderly, it was higher in males (7.4 to 6.58%), in the age group of 80 years or older (8.09 to 7.58%) and, on an urgent basis (6.96 to 6.54%), with annual coefficients of variation of 0.02%, 0.05% and 0.002%, respectively, and a stationary trend (Table 3).

Revista ARACÊ
ISSN: 2358-2472

Table 3. Mortality rate from iron deficiency anemia in the elderly and trend analysis by sex, age group, hospitalization type, before, during, and after the Covid-19 pandemic. Brazil, 2017 to 2023.

	Pre-Pandemic			Pandemic			Post-Pandemic		Trend analysis for the period 2017 to 2023		
Variables	2017	2018	2019	2020	2021	2022	2023	variation annual	95%[b]		p Trend
Sex											
Male	7,4	7,04	6,08	6,76	7,82	7,79	6,58	0,02	-0,3 a 0,4	0,842	Stationary
Female	6,19	5,51	6,51	6,55	6,96	6,23	6,02	0,04	-0,2 a 0,3	0,616	Stationary
Age group											
60-69	5,46	5,59	5,1	4,57	5,82	6,18	5,21	0,04	-0,2 a 0,3	0,130	Stationary
70-79	6,56	5,25	6,22	6,67	7,09	6,06	5,91	0,01	-0,3 a 0,3	0,881	Stationary
≥80	8,09	7,91	7,31	8,45	9	8,57	7,58	0,05	-0,3 a 0,4	0,676	Stationary
Character Hospitalization											
Elective	3,82	1,52	3,97	3,24	4,86	5,85	2,94	0,24	-0,4 a 1,0	0,395	Stationary
Urgency	6,96	6,55	6,42	6,82	7,52	7,03	6,54	0,02	-0.2 to 0.2	0,727	Stationary

Source. Ministry of Health – Hospital Information System of the SUS (SIH / SUS).

DISCUSSION

The results presented showed an increase in the coefficients of hospitalizations for iron deficiency anemia in the elderly in Brazil from 2017 to 2023, being higher during and after the Covid-19 pandemic and lower before this period. Another study carried out in the country, carried out between 2018 and 2023, also found a significant increase in the number of hospitalizations for this pathology during the pandemic (Branco; Bitencourt, 2023).

The analysis of the hospitalization coefficient and the trend by region was increasing in the North and Central-West regions, and stationary in the other regions. The South region had the highest hospitalization coefficients, before and during the covid-19 pandemic and after the pandemic the North region showed the highest hospitalization coefficient. The regional pattern of distribution of hospitalizations for this pathology in the five macro-regions of the country can be explained by the degree of development of each one and be associated with social factors (Espíndola *et al*., 2023). When observing the data collected, the high rate of hospitalization for iron deficiency anemia in the elderly in the country caused a negative socioeconomic impact with high public health expenditures.

Revista ARACÊ
ISSN: 2358-2472

Anemia in the geriatric population is a public health problem that affects more than 10% of the elderly over the age of 65 and often tends to be underdiagnosed due to the coexistence of some disease such as infections and neoplasms, leading to late diagnosis and consequently greater complications such as acute myocardial infarction, stroke, peripheral arterial insufficiency, thus increasing the chance of hospitalizations (Tarqui-Mamani *et al*., 2015; Aruda *et al*., 2019).

This increase in the rates of hospitalizations due to iron deficiency in the elderly before, during, and after Covid 19, may be related to the changes in habits that occurred during this period in Brazil, based on social distancing, implemented as an epidemiological control strategy. This measure negatively impacted access to nutritious food, affecting our eating habits and promoting an increase in sedentary lifestyle. This scenario directly influenced iron metabolism, through reduced adequate nutrient absorption and insufficient intake of iron-rich foods (Taghinijad *et al*., 2022).

The Covid-19 pandemic exacerbated the difficulties faced by the elderly, contributing to the worsening of health conditions that culminated in hospitalizations for iron deficiency anemia. This situation is directly related to socioeconomic conditions, since the elderly had their financial income affected, which made it difficult to access healthy food and caused harmful effects on physical and mental health. It is notorious that a deficient nutritional quality is a potential aggravating factor for vulnerability in old age (Romero *et al*., 2021).

Recent studies indicate a strong correlation between anemia and the severity of Covid-19, evidenced by the elevated levels of inflammatory markers, such as C-reactive protein, procalcitonin, creatinine, and D-dimer, observed in anemic patients (Tao *et al.,* 2021). In addition, hemoglobin levels measured in hospitals have been shown to be an important predictive factor for the development of the disease. Patients with low hemoglobin demonstrate a higher risk of ICU admission and reduced survival rates (Asadzadeh *et al.*, 2022). These findings suggest that both iron deficiency and impaired immune function are directly linked to worsening clinical status (Taghinejad *et al.,* 2022).

Hospitalization and mortality rates were higher in males (22.8 to 26.0 cases/100 thousand; 7.4 to 6.58%), in the age group of 80 years and over (53.6 to 60.0 cases/100 thousand; 8.09 to 7.58%), on an urgent basis (19.3 to 21.8/100 thousand; 6.96 to 6.54%). Vicenzil, Gomes, and Oliveira (2024) also highlight a growing trend in the prevalence of hospitalizations for iron deficiency anemia in men up to 80 years of age, which is

Revista ARACÊ
ISSN: 2358-2472

representative from 50 years of age onwards, with a peak of cases between 70 and 79 years of age.

The highest rates detected in elderly males over 80 years of age may be related to endocrine factors, such as the decrease in testosterone in adulthood, which is important in the production of red blood cells, favoring the appearance of iron deficiency anemia (Vicenzil; Gomes; Oliveira, 2024). Male susceptibility to anemia is exacerbated by increased iron loss, through gastrointestinal bleeding, urinary tract bleeding or in specific situations such as ulcers, hepatitis C and liver cirrhosis, promoting the worsening of the anemic condition (Brasil, 2013).

The urgency character, on the other hand, shows that the elderly were hospitalized with severe anemia, due to the lack of adequate preventive follow-up, related to the restrictions imposed during the pandemic. Some studies also show that during the Covid-19 pandemic, there was a worsening of cases of iron deficiency anemia, justified by the overload of the health system and delays in diagnosis. As a consequence, elderly people over 80 years of age were hospitalized urgently requiring intensive support, corroborating the result observed in the study (Bosco *et al*., 2013).

Increased mortality in the elderly can occur even when anemia is mild, and early diagnosis of the disease is important, as it can be reversible with appropriate treatment (Aruda et al., 2019). However, critical hemoglobin levels at the time of hospital admission emerge as a crucial predictor of disease progression to unfavorable outcomes, including higher risk of ICU admission and lower survival rate (Asadzadeh *et al*., 2022; Wang *et al*., 2022). Thus, it is important to identify the cause of anemia and its prevalence so that treatment can be initiated appropriately, preventing the worsening of the disease, reducing its progression, improving the prognosis and quality of life of elderly patients.

CONCLUSION

It is therefore concluded that hospitalizations for iron deficiency anemia among the Brazilian elderly, the object of the research, had a significant increase from 2017 to 2023, with an even sharper increase during and after the Covid-19 pandemic. This period brought additional challenges for the elderly, who had to adapt to the reduction in income and new lifestyle habits, often less healthy, contributing to the increase in sedentary lifestyle, since the practice of sports in gyms and outdoors became restricted during this period.

Revista ARACÊ
ISSN: 2358-2472

In terms of hospitalization and mortality rates due to iron deficiency anemia, the North, Northeast, and Midwest regions stand out, where significant increases were observed. The Southeast and South regions maintained stable coefficients. The Southeast recorded a slight increase, while the South reduced its coefficient of hospitalizations for iron deficiency anemia in the elderly population. Most hospitalizations were of an emergency nature, with a small increase in the rate of emergency hospitalizations.

Thus, the importance of improving nutritional conditions, access to early diagnosis and intensive treatment is highlighted. This can be achieved through the implementation of public policies that prioritize prevention, promotion, and health education, with an emphasis on healthy lifestyle and eating habits. These measures aim to reduce anemia rates among the elderly and, consequently, hospitalizations, health service costs and mortality rates, ensuring dignity and quality of life for this population.

Revista ARACÊ
ISSN: 2358-2472

REFERENCES

1. Antunes, J. L. F., & Cardoso, M. R. A. (2015). Uso da análise de séries temporais em estudos epidemiológicos. Epidemiologia e Serviços de Saúde, 24(3), 565-576. https://doi.org/10.5123/S1679-49742015000300024. Acessado em setembro de 2023.

2. Arruda, A. N. L., et al. (2019). Caracterização da anemia em idosos. Brazilian Journal of Health Review, 2(5), 4769-4776, sep./out.

3. Asadzadeh, R., et al. (2022). On-Admission Anemia and Survival Rate in COVID-19 Patients. Iranian Biomedical Journal, 26(5), 289-397.

4. Bellmann-Weiler, R., et al. (2020). Prevalence and Predictive Value of Anemia and Dysregulated Iron Homeostasis in Patients with COVID-19 Infection. Journal of Clinical Medicine, 9(8), 2429. https://pubmed.ncbi.nlm.nih.gov/32751400/. Acesso em: 10 abr. 2024.

5. Bosco, R. M., et al. (2013). Anemia and functional capacity in elderly Brazilian hospitalized patients. Cadernos de Saúde Pública, 29(7), 1322-1332, jul.

6. Branco, L. G., & Bittencourt, E. L. (2023). Arguição do perfil epidemiológico da anemia ferropriva no Brasil entre 2018 e 2022. Revista de Patologia do Tocantins, 10(2).

7. Brasil. CNS. (2012). Resolução Nº 466, de 12 de dezembro de 2012. Brasília. https://conselho.saude.gov.br/resolucoes/2012/Reso466.pdf. Acesso em setembro de 2024.

8. Brasil. Ministério da Saúde. (2023). Datasus. Tabnet – Sistema de Informações Hospitalares do SUS (SIH/SUS). Brasília: Ministério da Saúde. http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sih/cnv/niuf.def. Acesso em: 20 de setembro de 2023.

9. Brasil. Ministério da Saúde. (2013). Política Nacional de Atenção Integral à Saúde do Homem. Brasília: Ministério da Saúde.

10. Costa, L. S. G., et al. (2023). O perfil epidemiológico dos pacientes hospitalizados com anemia por deficiência de ferro e a relação da dietoterapia no prognóstico da doença. Revista Foco, 16(9), e2713. https://ojs.focopublicacoes.com.br/foco/article/view/2713. Acesso em: 7 out. 2024.

11. IBGE. Instituto Brasileiro de Geografia e Estatística. (2018). Projeção da população 2018: número de habitantes do país deve parar de crescer em 2047. Rio de Janeiro: IBGE. https://agenciadenoticias.ibge.gov.br/agencia-sala-de-imprensa/2013-agencia-de-noticias/releases/21837-projecao-da-populacao-2018-numero-de-habitantes-do-pais-deve-parar-de-crescer-em-2047#:~:text=A%20popula%C3%A7%C3%A3o%20total%20projetada%20para,(228%2C4%20milh%C3%B5es). Acesso em: 17 mai. 2024.

Revista ARACÊ
ISSN: 2358-2472

12. IBGE. (2024). Projeção da população do Brasil e Unidades da Federação por sexo e idade para o período 2000-2030. https://www.ibge.gov.br/estatisticas/sociais/populacao/9109-projecao-da-populacao.html. Acesso em 10 set. 2024.

13. Machado, I. E., et al. (2019). Prevalência de anemia em adultos e idosos brasileiros. Revista Brasileira de Epidemiologia, 22, e190008, Supl. 2. https://www.scielo.br/j/rbepid/a/q47JnZ8YGgcqbN8gNDyQNJL/?lang=pt. Acesso em: 19 abr. 2024.

14. Romero, D. E., et al. (2021). Idosos no contexto da pandemia da COVID-19 no Brasil: efeitos nas condições de saúde, renda e trabalho. Cadernos de Saúde Pública, 37(3). https://www.scielo.br/j/csp/a/gXG5RYBXmdhc8ZtvKjt7kzc/?format=pdf&lang=pt. Acesso em: 02 out. 2024.

15. Taghinejad, Z., et al. (2022). Iron deficiency anemia and COVID-19. Journal of Medical Microbiology and Infectious Diseases, 10(4), 157-162. https://www.researchgate.net/publication/366783039_Iron_Deficiency_Anemia_and_COVID-19. Acesso em: 7 out. 2024.

16. Tao, Z., et al. (2021). Anemia is associated with severe illness in COVID-19: A retrospective cohort study. Journal of Medicine Virology, 93(3), 1478-1488. https://pubmed.ncbi.nlm.nih.gov/32813298/#:~:text=Risk%20factors%20associated%20with%20the,and%20severe%20COVID-19%20illness. Acesso em: 02 mai. 2024.

17. Tarqui-Mamani, C., et al. (2015). Prevalencia de anemia y factores asociados en adultos mayores peruanos. Revista Peruana de Medicina Experimental y Salud Pública, 32(4), 687-692.

18. Vicenzil, G. S., Gomes, E. C. Z., & Oliveiras, J. K. (2024). Anemia ferropriva e COVID-19: estudo descritivo de internações hospitalares no Paraná, entre 2018 e 2022. Revista Ibero-Americana de Humanidades, Ciências e Educação, 10(4). ISSN 2675-3375.

19. Wang, Y., et al. (2022). Significant association between anemia and higher risk for COVID-19 mortality: A meta-analysis of adjusted effect estimates. American Journal of Emergency Medicine, 58, 281-285.