ORIGINAL ARTICLE

TREND OF HOSPITALIZATIONS FOR DISEASES OF THE CIRCULATORY SYSTEM SENSITIVE TO PRIMARY CARE IN THE WESTERN AMAZON

Tendência das internações por doenças do aparelho circulatório sensíveis à Atenção Primária na Amazônia Ocidental

Tendencia de hospitalizaciones por enfermidades del sistema circulatório sensibles a la atencion primaria em la Amazonia Occidental

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ABSTRACT

Introduction: Hospitalizations for causes sensitive to primary care are an indicator of the effectiveness and accessibility of health care offered by primary care for certain conditions. **Objective:** To analyze the trend in hospitalizations for diseases of the circulatory system. **Method:** This is an ecological and temporal trend study that analyzes hospitalization rates for diseases of the circulatory system sensitive to primary care in the Western Amazon, between 2008 and 2022. To assess trends, the annual percentage variation in hospitalizations was calculated with confidence of 95%, using the Joinpoint Regression Program software, in addition to analyzes with the R and Joinpoint software. **Results:** During the period studied, hospitalizations for diseases of the circulatory system occurred mainly among individuals aged 60 to 79 years (56%), with a predominance of men (56%) and those with a brown body (53%). The majority of these admissions were urgent (79%) and tested at improved discharge (70%). Heart failure was the main cause (38%), with Amazonas recording the highest number of hospitalizations (47%). **Conclusion:** A detailed analysis can identify patterns and provide essential data to improve primary health care in the Western Amazon.

Keywords: Chronic Disease; Cardiovascular Diseases; Conditions Sensitive to Primary Care; Hospitalization; Hospital Information System.

RESUMO

Introdução: As hospitalizações por causas sensíveis à atenção primária são um indicador de eficácia e acessibilidade dos cuidados de saúde oferecidos pela atenção primária para determinadas condições. **Objetivo:** Analisar a tendência das internações por doenças do aparelho circulatório. **Método:** Este é um estudo ecológico e de tendência temporal que analisa as taxas de internação por doenças do aparelho circulatório sensível à atenção primária na Amazônia Ocidental, entre 2008 e 2022. Para avaliar as tendências, foi calculada a variação percentual anual das internações com confiança de 95%, utilizando o *software Joinpoint Regression Program*, além das análises com os *softwares* R e *Joinpoint*. **Resultados:** Durante o período estudado, as internações por doenças do aparelho circulatório ocorreram principalmente entre indivíduos de 60 a 79 anos (56%), com predominância masculina (56%) e de corpo pardo (53%). A maioria dessas internações foi de urgência (79%) e testada em alta melhorada (70%). A insuficiência cardíaca foi a causa principal (38%), com o Amazonas registrando o maior número de internações (47%). **Conclusão:** Uma análise detalhada pode identificar padrões e fornecer dados essenciais para melhorar os cuidados primários de saúde na Amazônia Ocidental.

Palavras-chave: Doença Crônica; Doenças Cardiovasculares; Condições Sensíveis à Atenção Primária; Hospitalização; Sistema de Informação Hospitalar.

RESUMEN

Introducción: Las hospitalizaciones por causas sensibles a la atención primaria son un indicador de la efectividad y accesibilidad de la atención sanitaria que ofrece la atención primaria para determinadas patologías **Objetivo:** Analizar la tendencia de las hospitalizaciones por enfermedades del sistema circulatorio. **Método:** Se trata de un estudio de tendencias ecológicas y temporales que analiza las tasas de hospitalización por enfermedades del sistema circulatorio sensibles a la atención primaria en la Amazonía Occidental, entre 2008 y 2022. Para evaluar las tendencias, se calculó la variación porcentual anual de las hospitalizaciones con una confianza del 95 %, utilizando el software Joinpoint Regression Program, además de análisis con el software R y Joinpoint. **Resultados:** Durante el período estudiado, las hospitalizaciones por enfermedades del sistema circulatorio ocurrieron principalmente entre personas de 60 a 79 años (56%), con predominio de hombres (56%) y personas de cuerpo moreno (53%). La mayoría de estas admisiones fueron urgentes (79%) y se evaluaron en el momento del alta mejorada (70%). La insuficiencia cardíaca fue la principal causa (38%), siendo Amazonas el mayor número de hospitalizaciones (47%). **Conclusión:** Un análisis detallado puede identificar patrones y proporcionar datos esenciales para mejorar la atención primaria de salud en la Amazonía Occidental.

Palabras clave: Enfermedad Crónica; Enfermedades Cardiovasculares; Condiciones Sensibles a la Atención Primaria; Hospitalización; Sistema de Información

RESUMEN

INTRODUCTION

Non-communicable diseases (NCDs) currently represent one of the main challenges for public health due to their rapid growth, high prevalence and significant mortality, which are influenced by the process of epidemiological transition, population aging and changes in lifestyle habits. In Brazil, this scenario is complex, characterized by the coexistence of chronic, infectious and parasitic diseases, in addition to regional and socioeconomic inequalities. [1-2]

The epidemiological transition can be monitored through health indicators, which measure events and impacts on the population. For example, Hospitalization rates for Ambulatory Care Sensitive Conditions (ACSC), which aim to measure hospitalizations that could be avoided if there were timely access to quality health care in Primary Health Care (PHC). [3]

The Brazilian specific list of ACSC includes diseases of the circulatory system: angina, cerebrovascular diseases, arterial hypertension and heart failure,[4] which correspond to the leading cause of hospitalizations and mortality in Brazil. According to data available by the mortality information system in Brazil, by the Global Burden of Disease (GBD) in 2019, and "Cardiovascular Statistics, Brazil – 2021", mortality from cardiovascular diseases (CVD) and stroke (CVA) in the North region corresponds to 33.1%, being the highest among the other regions of the country, that highlights the public health problem.[5]

Brazilian regions vary socioeconomically, with the North, being the least developed, especially the Western Amazon, that is comprising by Acre, Amazonas, Rondônia and Roraima. It faces significant health challenges due to poor socioeconomic conditions and limited access to health services. In recent decades, social and economic changes have impacted the environment and living conditions of the population.[6]

Therefore, understanding the sociodemographic and clinical profile of hospitalizations due to diseases of the circulatory system in Western Amazonia is essential to improve public policies and health interventions. The present study aims to analyze the temporal trend of hospitalizations due to diseases of the circulatory system in Western Amazonia.

METHOD

This is an observational ecological study, which used secondary information from Hospital Information System of the Unified Health System (SIH/SUS). All data used in the study are aggregated, in the public domain and with unrestricted access.

The Western Amazon, composed of the states of Acre, Amazonas, Rondônia, and Roraima, was the study scenario. All records of hospitalizations due to circulatory system diseases sensitive to primary care were selected, according to the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10), namely: I10, I11, I20, I50, I63 to I67, in the period from January 2008 to December 2022. These diseases were subsequently grouped into (I50), (I60-I69), (I10), and (I20), corresponding respectively to Congestive Heart Failure (CHF), cerebrovascular diseases, Primary Essential Hypertension (SAH), and angina pectoris.

The variables assessed were age, skin color, nature of hospitalization, reason for discharge or stay, bed specialty, death during hospitalization, and place of hospitalization. The variables were described in absolute numbers and proportions and stratified by state. To assess statistical differences between states, Pearson's chi-square test was performed, with a significance level of 5%.

Crude, age-specific, and age-standardized hospitalization rates were calculated. Rates were presented for total ambulatory care-sensitive conditions of the total circulatory system and for each specific cause.

The rates were calculated using as numerator the hospitalizations due to circulatory system diseases sensitive to primary care corresponding to the year of the denominator to which the rate refers and, as denominator, the person-year, based on the census or intercensal population for July 1 (middle of the period analyzed), multiplied by the number of years to which the rate refers. The rates were expressed per 10,000 inhabitants/year.

To estimate the annual percentage change in rates, the analysis was performed using Joinpoint, in which a 95% confidence interval (95% CI) was estimated for each line segment. Regression identifies points of statistically significant changes and the annual percentage change (Annual Percent Change - APC) in hospitalization rates. This statistical modeling technique aims to explain the relationship between two variables through regression lines, and the points that join these lines are called junction or inflection points.[7] And, it allows the adjustment of data from a series based on the minimum number of joinpoints when testing whether the inclusion of one or more points is significant. The APC in different periods is determined by the number of inflection points in the model. To minimize possible autocorrelations in the data, the option "fit an autocorrelated errors model based on the data" was used before the analyses.[7]

The software R version 4.1.1 with the microdatasus, tidyverse and gtsummary packages and Joinpoint (Statistical Research and Applications Branch, National Cancer Institute, United States), version 5.0.2 was used.

RESULTADOS

There were 201,847 hospitalizations due to circulatory system diseases sensitive to primary care, from 2008 to 2022, in Western Amazonia, recorded in SIH/SUS.

Table 1 – Distribution of sociodemographic and clinical characteristics of hospitalizations due to circulatory system diseases sensitive to primary care, by states, 2008-2022.

Variables	AC N=19,669	AM N = 94,544[1]	RO N = 73,897[1]	RR N = 13,737[1]	X²
Age group	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**p-value**
≤ 29 years	1,092(5.5%)	5,215 (5.5%)	3,099 (4.1%)	795 (5.7%)	<0.001
30-39 years	977 (4.9%)	4,486 (4.7%)	3,705 (5.0%)	743 (5.4%)	
40-49 years	1,865 (9.4%)	9,289 (9.8%)	7,405 (10.0%)	1,227 (8.9%)	
50-59 years	3,236 (16.4%)	16,373 (17.3%)	12,503 (16.9%)	2,360 (17.1%)	
60-69 years	4,409 (22.4%)	22,665 (23.9%)	17,349 (23.4%)	3,181 (23.1%)	
70-79 years	4,622 (23.4%)	21,485 (22.7%)	18,045 (24.4%)	3,094 (22.5%)	
≥ 80 years	3,468 (17.6%)	15,031 (15.8%)	11,791 (15.9%)	2,337 (17.0%)	
Total	19,669 (100%)	94,544 (100 %)	73,897 (100 %)	13,737 (100 %)	
Diseases					
Cerebrovascular	6,929 (35.2%)	30,671 (32.4%)	17,612 (23.8%)	4,776 (34.7%)	
Arterial hypertension	4,265 (21.6%)	15,115 (15.9%)	24,266 (32.8%)	2,194 (15.9%)	
Angina	1,653 (8.4%)	10,818 (11.4%)	5,664 (7.6%)	1,170 (8.5%)	

|					
Heart failure	6,822 (34.6%)	37,940 (40.1%)	26,355 (35.6%)	5,597 (40.7%)	
Total	19,669 (100 %)	94,544 (100%)	73,897 (100%)	13,737 (100%)	
Sex					<0.001
Female	8,704 (44.1%)	41,555 (43.9%)	33,628 (45.5%)	5,927 (43.1%)	
Male	10,965 (55.7%)	52,989 (56.0%)	40,269 (54.4%)	7,810 (56.8%)	
Total	19,669 (100%)	94,544 (100%)	73,897 (100%)	13,737 (100%)	
Race/skin color					<0.001
Yellow	728 (7.1%)	816 (1.6%)	1,607 (5.0%)	60 (0.7%)	
White	603 (5.9%)	4,077 (5.3%)	5,456 (17.2%)	274 (3.2%)	
Indigenous	74 (0.7%)	702 (0.9%)	339 (1.0%)	296 (3.5%)	
Brown	8,658 (84.8%)	68,539 (89.7%)	22,996 (72.7%)	7,665 (91.3%)	
Black	135 (1.3%)	2,205 (2.8%)	1,229 (3.8%)	92 (1.0%)	
Total	10,198 (100%)	76,339 (100%)	31,627 (100%)	8,387 (100%)	
Admission					<0.001
Elective	5,025 (25.5%)	28,341 (29.9%)	7,484 (10.1%)	2,352 (17.1%)	
Urgency	14,644 (74.4%)	66,201 (70.0%)	66,413 (89.8%)	11,385 (82.8%)	
Others	0 (0%)	2 (<0.1%)	0 (0%)	0 (0%)	
Total	19,669 (100%)	94,544 (100%)	73,897 (100%)	13,737 (100%)	
Health reason					
Discharge on request	135 (0.7%)	431 (0.4%)	485 (0.6%)	25 (0.3%)	
Discharge with return to follow-up	264 (1.3%)	4,394 (4.6%)	824 (1.1%)	52 (0.3%)	
Discharge improved	13,128 (68.1%)	60,310 (63.7%)	57,680 (78.0%)	9,795 (71.3%)	
Death with certificate provided by the doctor	3,015 (15.6%)	7,888 (8.3%)	6,085 (8.2%)	1,633 (11.8%)	
Others	2,730 (14.1%)	21,521 (22.7%)	8,823 (11.9%)	2,232 (16.2%)	
Total	19,272 (100%)	94,544 (100%)	73,897 (100%)	13,737 (100%)	
Death					<0.001
No	16,640 (84.6%)	85,511 (90.4%)	67,643 (91.5%)	12,086 (87.9%)	
Yes	3,029 (15.3%)	9,033 (9.5%)	6,254 (8.4%)	1,651 (12.0%)	
Total	19,669 (100%)	94,544 (100%)	73,897 (100%)	13,737 (100%)	

AC: Acre, AM: Amazonas, RO: Rondônia, RR: Roraima, X^2: Pearson chi-square test with significance level of 5%.
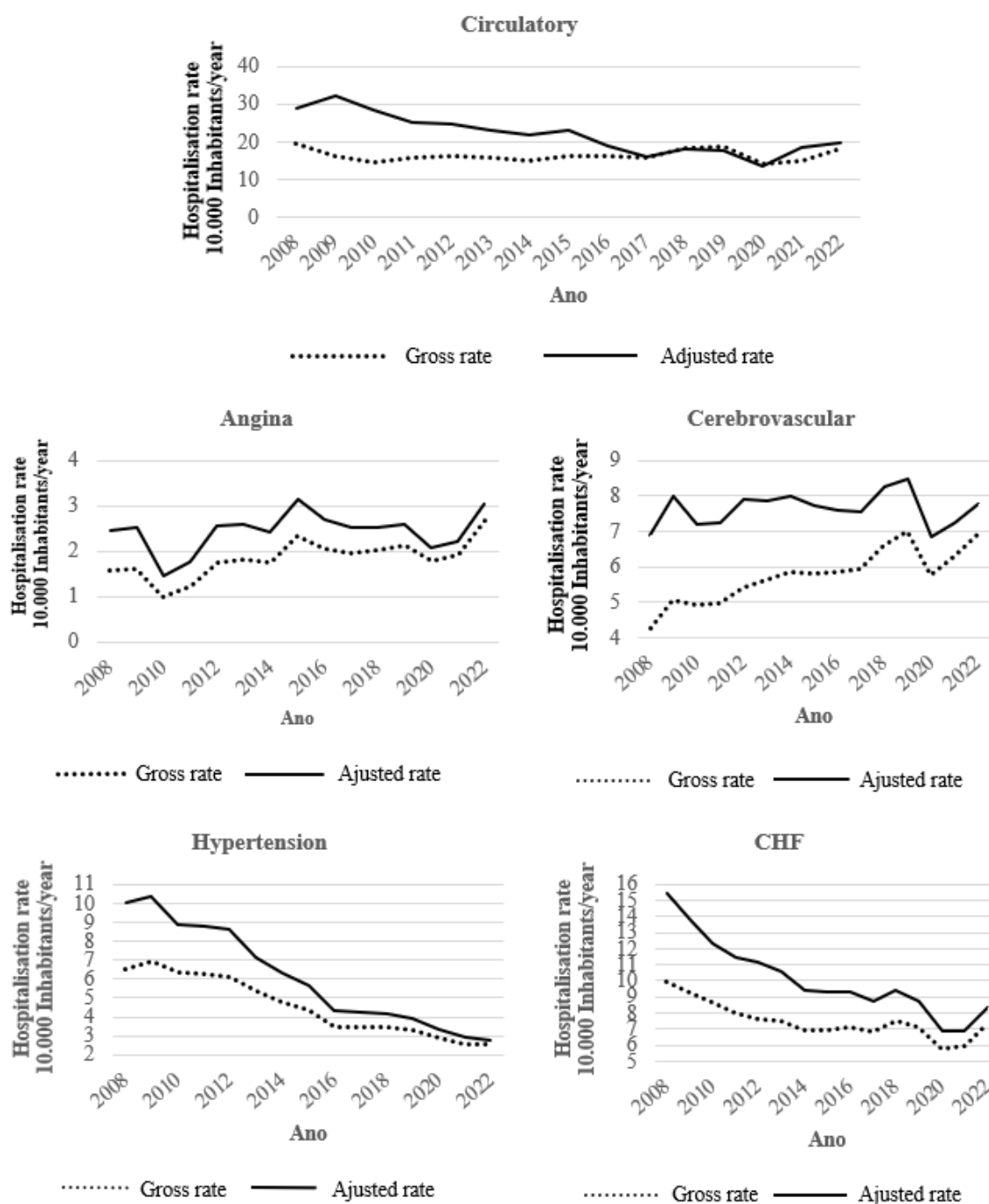Source: Authors.

In Table 1, a higher frequency of hospitalizations among males was observed in all states of Western Amazonia, with the highest proportions identified in Roraima 56.8% (N: 7,810) p> 0.01. Among the "age groups", higher rates were observed between two states, with a higher frequency of hospitalizations in the state of Rondônia in the age group of 70 to 79 years 24.4% (N: 18,045) and Amazonas among individuals in the age group of 60 to 69 years 23.9% (N: 22,665). Among the oldest old, 80 years and over, hospitalizations were less frequent in this age group (p<0.001).

The predominant skin color among hospitalized individuals was brown, being more frequent in Roraima, which corresponded to 91.3% (N: 7,665) of hospitalizations, followed by Amazonas with 89.7% (N: 68,539) and Acre with 84.8% (N: 8,658) of hospitalizations.

Regarding the "type of hospitalization", there was a predominance of "urgency", with emphasis on Rondônia 89.8% (N: 66,413), Roraima 82.8% (N: 11,385) and Acre 74.4% (N: 14,644). The "elective nature", in turn, presented the highest percentage of hospitalizations in Amazonas 29.9% (N: 28,341). "Clinical improvement" was the "reason for leaving or staying" in all states evaluated (<0.001), with Rondônia standing out at 78.0% (N: 57,680). Acre had the highest percentage of "death during hospitalization", at 15.3% (N: 3,015) (table 1).

Figure 1 - Crude and adjusted hospitalization rates for circulatory system diseases, by primary care-sensitive conditions, Western Amazon, 2008-2022.

Circulatory

Angina

Cerebrovascular

Hypertension

CHF
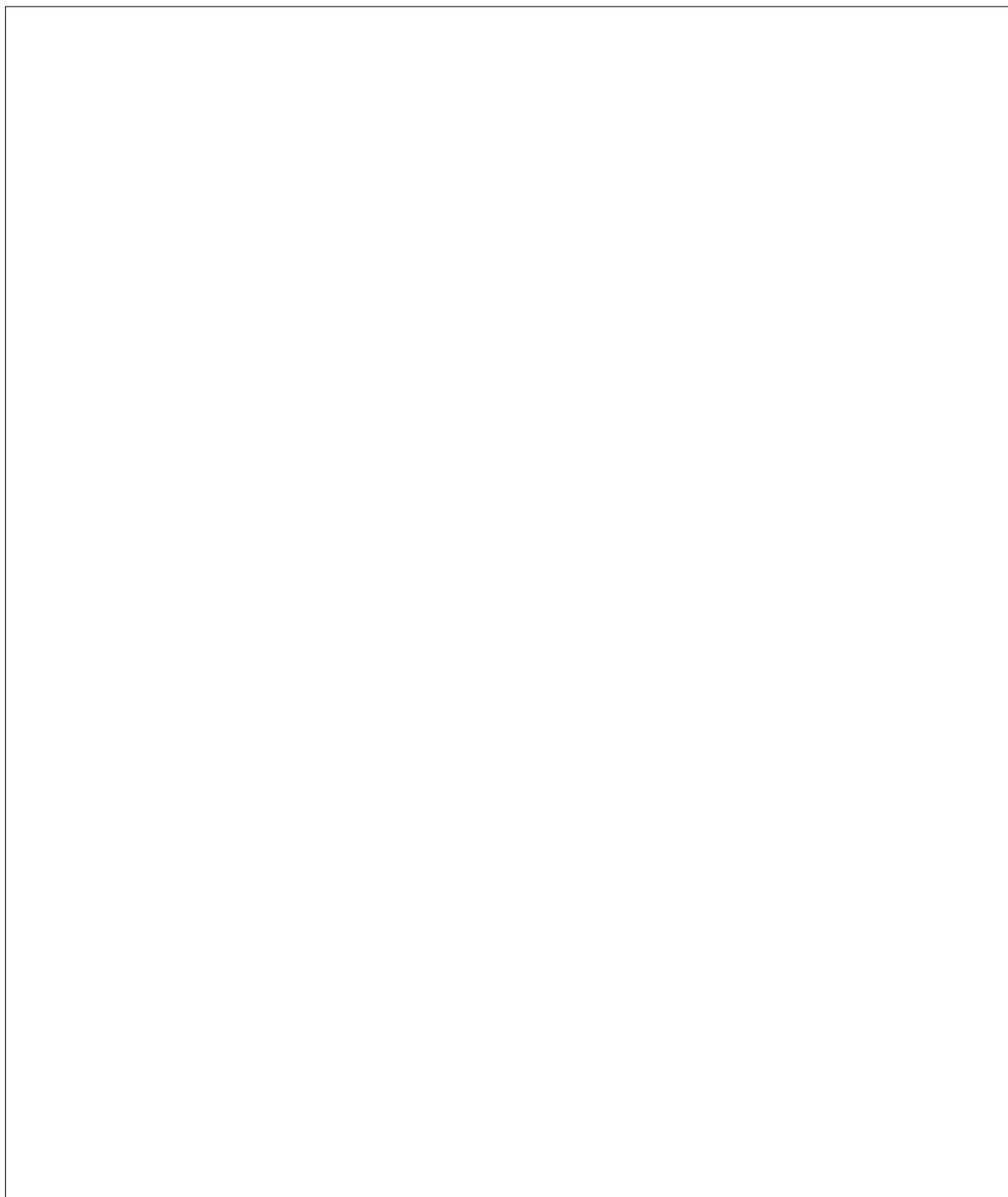
Source: Authors.

Figure 1 shows the decrease in hospitalization rates due to circulatory system diseases in Western Amazonia from 2008 to 2022. The most evident reduction was in hospitalizations due to hypertension, which varied between 10.2/10,000 inhabitants in 2008 and 2.79/10,000 in 2022. And, CHF, which varied between 15.45/10,000 inhabitants in 2008 and 8.33/10,000 inhabitants in 2022.

Figure 2 – Hospitalization rate adjusted for circulatory system diseases sensitive to primary care, by states of Western Amazon, 2008-2022.
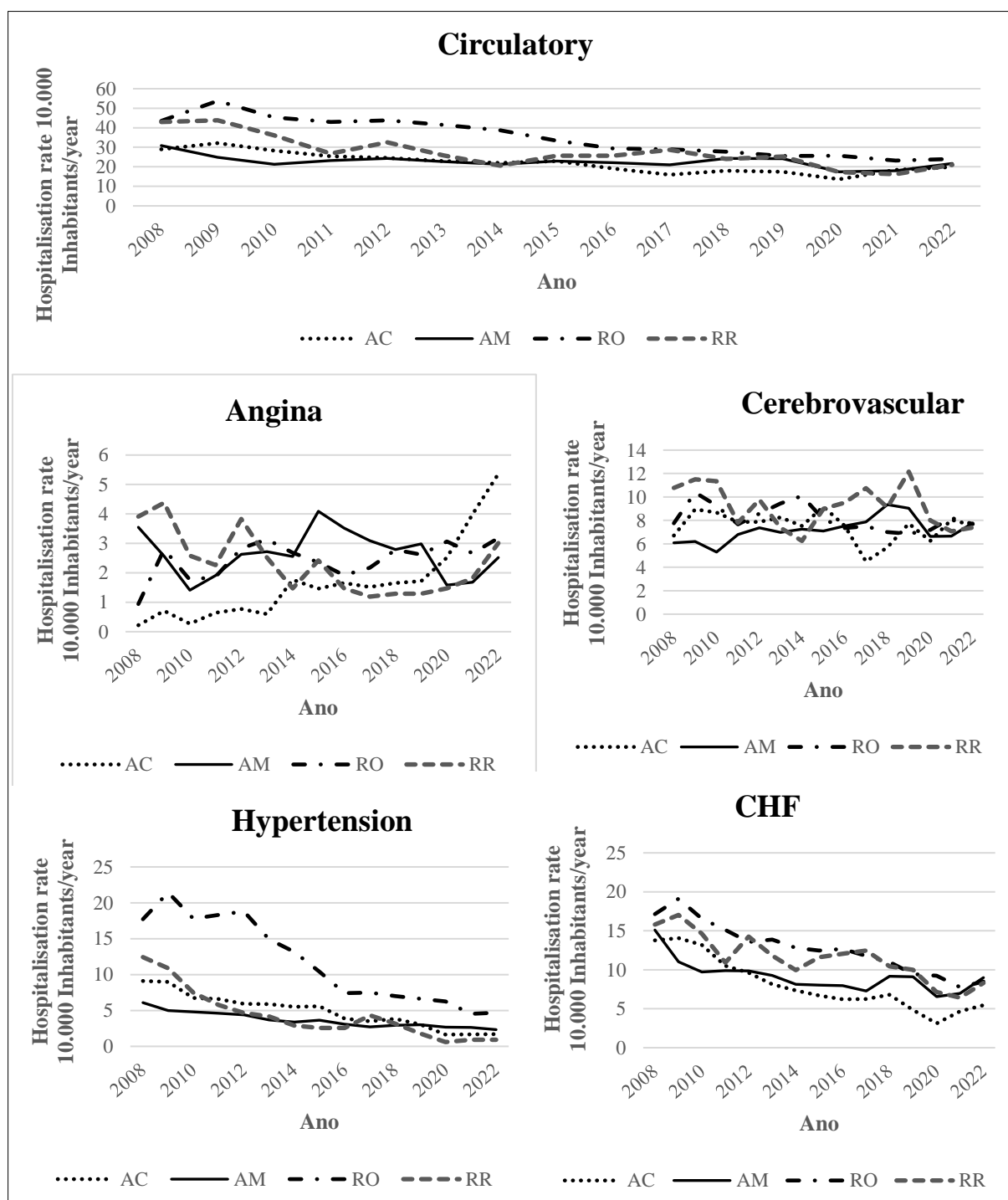
AC: Acre, AM: Amazonas, RO: Rondônia e RR: Roraima,
Source: Authors.

The rates of hospitalizations due to diseases of the circulatory system were higher in the states of Rondônia, ranging from 43.56 in 2008 to 24.06 in 2022, and in Roraima, with 42.91 in 2008 and 20.96 in 2022, per 10,000 inhabitants. Regarding hospitalizations due to angina, the states with the highest rates were Amazonas with 4.09 in 2012 and Acre, which recorded the highest rate in 2022 of 5.36 hospitalizations per 10,000 inhabitants. Cerebrovascular diseases had the highest rates in Amazonas and Roraima. Rondônia and Roraima significantly

reduced their hospitalization rates for hypertension, respectively from 17.14 in 2008 to 4.68 in 2022 and from 12.43 in 2008 to 0.92 in 2022. For CHF rates, all states presented high rates. Acre had adjusted rates of 14.06 in 2008 and 13.20 in 2009; in Amazonas it was 15.10 in 2008; in Rondônia it was 17.14 in the same year; and Roraima registered 17.03 in 2009 (Figure 2).

Table 2 - Temporal trends in hospitalization rates for angina, cerebrovascular diseases, systemic arterial hypertension and congestive heart failure, Western Amazon, 2008-2022.

Diseases of the circulatory system					
LOCATION	APC	Joinpoint	IC 95%	AAPC	Trend
Acre	-5,94	2020	-10,03; -4,49	-	Decreasing*
Acre	16,20	2022	-2,91; 26,35	-	Increasing
Amazonas	-1,90	2022	-3,38; -0,39	-	Decreasing*
Rondônia	-5,71	2022	-6,76; -4,62	-	Decreasing*
Roraima	-5,34	2022	-8,21; -2,39	-	Decreasing*
Amazônia Ocidental	-3,83	2022	-4,74; -2,92	-	Decreasing*
Angina					
LOCATION	APC	PI	IC 95%	AAPC	Tendência
Acre	20,32	2022	-	-	Crescente
Amazonas	-34,23	2010	-47,40; -11,44	-	Decreasing*
Amazonas	18,73	2015	8,88; 44,13	-	Increasing*
Amazonas	-9,55	2022	-17,22; -4,42	-	Decreasing*
Rondônia	4,08	2022	0,37; 8,07	-	Increasing*
Roraima	-10,98	2019	-25,93; -6,20	-	Decreasing*
Roraima	34,54	2022	-1,89; 95,09	-	Increasing
Amazônia Ocidental	1,48	2022	0,37; 8,07	-	Increasing*
Cerebrovascular					
LOCATION	APC	PI	IC 95%	AAPC	Tendência
Acre	-1,30	2022	-3,83; 1,36	-	Decreasing
Amazonas	3,85	2018	1,69; 18,19	-	Increasing*
Amazonas	-4,77	2022	-21,78; 1,75	-	Decreasing
Rondônia	-1,61	2022	-3,84; 0,62	-	Decreasing
Roraima	-1,61	2022	-4,30; 1,20	-	Decreasing
Amazônia Ocidental	0,23	2022	-0,89,1,35	-	Increasing
Sistemic Arterial Hypertension (SAH)					
LOCATION	APC	PI	IC 95%	AAPC	Tendência
Acre	-9,21	2018	-11,60; 10,97	-12,41	Decreasing
Acre	-19,92	2022	-38,58; -12,27	-	Decreasing*
Amazonas	-8,19	2014	-15,50; -5,22	-6,045	Decreasing*
Amazonas	-4,4	2022	-7,24; 2,94	-	Decreasing
Rondônia	-0,04	2012	-5,59; 13,95	-9,45	Decreasing
Rondônia	-18,66	2016	-25,60; 13,19	-	Decreasing*
Rondônia	-8,95	2022	-12,64; 3,11	-	Decreasing
Roraima	-16,82	2022	-20,46,-12,87	-	Decreasing*
Amazônia Ocidental	-9,60	2022	-10,43; -8,74	-	Decreasing*
Congestive Heart Failure (CFH)					
LOCATION	APC	PI	IC 95%	AAPC	Tendência
Acre	-4,45	2022	-5,69; -3,19	-	Decreasing*
Amazonas	-19,38	2010	-29,28; -0,35	-4,64	Decreasing*
Amazonas	-1,94	2022	-20,16; 12,21	-	Decreasing

Rondônia	-5,58	2022	-6,52; -4,64	-	Decreasing*
Roraima	-5,19	2022	-6,86; -3,46	-	Decreasing*
Amazônia Ocidental	-4,67	2022	-5,96; -3,36	-	Decreasing*

APC: Annual percent change, AAPC: average annual percent change, * significance level ≤ 5%.
Fonte: Autores.

In Table 2, hospitalizations for angina in Western Amazonia increased, especially in Acre (20.3% per year) and Rondônia (4.8% per year). In Amazonas, hospitalizations for cerebrovascular diseases grew 3.8% per year until 2018. Hospitalizations for Systemic Arterial Hypertension (SAH) decreased significantly: in Acre (19.9% from 2019), in Amazonas (8.1% between 2008 and 2014), in Rondônia (18.6% from 2013) and Roraima (16.8% per year during the study). There was a reduction in hospitalizations for Congestive Heart Failure (CHF) in all states, with Rondônia and Roraima showing annual reductions of 5.5% and 5.1%, respectively.

DISCUSSION

There is no doubt that diseases of the circulatory system in Western Amazonia presented peculiarities in sociodemographic and clinical aspects, being more frequent in males, in the age group 60 to 79 years, and requiring emergency hospitalization. Regarding the specific cause of hospitalization, CHF was the most frequent in Acre, Amazonas and Roraima, and SAH in Rondônia.

The higher hospitalization profile among men points to possible cultural and market factors that make men the providers, with less time for health care, who seek health care with serious clinical conditions that require hospitalization.[8] The higher frequency of hospitalizations in the age group of 60 to 79 years suggests late diagnosis of the disease, with an asymptomatic course and clinical manifestations in advanced stages.[9] The predominance of individuals with brown skin color is in line with the Brazilian population, since, according to the Brazilian Institute of Geography and Statistics (IBGE), 92.1 million inhabitants declare themselves to be brown.[10]

The high proportion of emergency hospitalizations may be related to the severity of the diseases, such as ischemic vascular incidents, in which require rapid hospital admissions.[9] However, improved discharge was the most frequent reason for discharge in all states, that may indicate the effectiveness of treatment protocols during the hospitalization period.

Although the population of Western Amazonia has a similar epidemiological profile, when compared, the states presented different hospitalization rates, after adjustment. The factors that may influence such differences include the level of socioeconomic development, primary care coverage, quality of care provided, access barriers, rural isolation, among others.

In 2020, the lowest percentages of primary care coverage were observed in the states of the North region, being 77.1% in Amazonas, 75.2% in Rondônia, 87.2% in Acre and 84.6% in Roraima.[11]

Regarding diseases of the circulatory system in Western Amazonia, a decline in hospitalization rates was observed. For hypertension, a significant decrease was observed, which suggests an improvement in the management and control of hypertension in the region over the years, and the expansion of PHC programs and integration with the SUS had a positive impact on reducing hospitalizations.[12]

Hospitalizations due to angina have increased in Western Amazonia, which could suggest a worsening of the population's heart condition, due to a sedentary lifestyle, poor diet, obesity and increasingly common risk behaviors.[13]

Infrastructure development in the Amazon region faces health-related challenges such as accelerated migration and increased demand for services. In addition, the aging population and the adoption of less healthy lifestyles directly impact quality of life and access to adequate health care, indicating emerging public health issues in the region.[14] This may partially explain the reduction in hospitalization rates for some diseases and, on the other hand, an increase in others.

Acre had high rates of hospitalizations for diseases of the circulatory system during the period. This may be partially attributed to low socioeconomic development, geographic isolation and lack of investment in health and infrastructure, reflected in its Human Development Index (HDI) of 0.71, considered average by IBGE.[15]

Considering individual health determinants, obesity/overweight is a relevant risk factor in the state. According to data from the Surveillance System for Risk and Protection Factors for Chronic Diseases by Telephone Survey (Vigitel), in 2021, Rio Branco had a percentage of adults (≥18 years old) with excess weight (BMI ≥25 kg/m2) of 63.2% (95% CI 55.6; 70.8) for males and 57.8% (95% CI 52.0; 63.6) for females, being one of the highest among Brazilian states.[16]

Malta and collegues (2018) conducted a study on the recurrence of hypertension, whose parameters were self-reported, measured by instruments and by medication use. It was shown that Acre has a high prevalence of hypertension measured by instrument with 15.6% (95% CI 13.9-17.4), together with hypertension measured by instrument and/or medication use, being 22.8% (95% CI 209-24.8) of the cases. It stands out as one of the states with the highest prevalence of hypertension in the Western Amazon.[17]

Corroborated by the study on PHC coverage in rural and urban populations in the North of Brazil, which showed the scarcity of Basic Health Units (UBS) that participate in the Program for Improving Access and Quality of Primary Care (PMAQ-AB), with 17 (18.7%) in rural areas and 23 (25.6%) in urban areas. Evidencing that underdevelopment and geographic isolation hinder progress in health in Acre, compared to other states.[18]

Amazonas, one of the states with the largest territorial extension and socioeconomic development in the Northern Region, showed few variations in the rates of hospitalizations due to circulatory diseases sensitive to primary care during the study period. The rates of hospitalization due to CHF varied. However, the reduction was significant. It is believed that this behavior can be explained by the intensive health education action offered by the State Health Department (SES) regarding the types of care in the Basic Health Unit (UBS), Emergency Care Services (SPA) or Emergency Room.[19] Associated with clinical studies for alternatives in the treatment of heart failure conducted by the Francisco Mendes Heart Hospital Foundation (FHCFM), a reference in cardiovascular care in the North region.[20]

Furthermore, Amazonas stood out in improving the indicators of the Previne Brasil program, which allow the evaluation of the quality of the results of strategic actions in health. The state presented 15 municipalities with scores above eight and Manaus came first in the national ranking.[21]

Rondônia has one of the highest socioeconomic growth rates in the North Region and the highest rates of hospitalizations due to diseases of the circulatory system, mainly due to Systemic Arterial Hypertension (SAH), which may be associated with the delay in seeking health services.[22] Despite presenting the highest hospitalization rates, a significant decreasing trend was observed, especially for HAS and CHF over the years, which can be attributed to

local government initiatives in PHC, such as the Hiperdia program implemented since 2017. The program monitors patients with hypertension and diabetes, with all Health Units in the municipality participating and offering services such as blood pressure measurement, blood glucose tests, among others.[23]

In recent years, Roraima has had serious complications in accessing healthcare, due to the lack of structure, medicines, equipment and other essential resources.[24] The state is divided into two health regions and relies heavily on the SUS, with only 5.53% of the population having health insurance.[25] The situation is aggravated by the influx of refugees from Venezuela, which is overwhelming public health services. This compromises the quality and efficiency of care for both the local population and refugees, and can lead to the development of other diseases due to the lack of basic care.

Although the reduction in hospitalization rates may indicate improvements in disease prevention and management strategies in the region, it is important to consider that this factor still represents a significant burden on the health system and an ongoing concern for public health in Western Amazonia.

As limitations of the study, the incompleteness of some variables in the database made it impossible to perform a more detailed evaluation of the epidemiological profile. And the limited comparative analysis due to the few national studies addressing the topic.

As a strong point, the study provides an overview of the main causes of hospitalizations in Western Amazonia. The standardization of rates allowed comparisons between states, and no other national studies using the same methodology were found in the literature. Knowledge about the behavior of trends by state and disease can help identify gaps and potential in addressing these problems in public health.

CONCLUSION

The study showed that the main causes of hospitalizations due to circulatory system diseases in Western Amazonia were congestive heart failure and systemic arterial hypertension, being more frequent in men, in the age group of 60 to 79 years and with an emergency nature. Regional differences were observed in hospitalization rates. The decreasing trend for some conditions, such as hypertension, suggests advances in public health policies, such as expanding Primary Health Care coverage. On the other hand, the increasing trends in hospitalizations due to angina also highlight the need for continuous improvements in access and quality of care, especially in states with less socioeconomic development.

The findings of this study indicate that the implementation of public health policies, especially in PHC, appear to have contributed to the reduction in hospitalizations due to systemic arterial hypertension and congestive heart failure, indicating that preventive actions have resulted in positive effects in certain locations. Furthermore, the variation in rates between states suggests that more equitable health policies adapted to local particularities are essential to reduce disparities in access and quality of care.

There are gaps in knowledge regarding the behavior of hospital admission rates in the Amazon, and this study can contribute by presenting the analysis by state. The evaluation of the indicator of hospital admissions for circulatory system diseases sensitive to primary care allowed us to identify the main variations in health conditions, as well as indirectly assess the quality of Primary Health Care assistance for these conditions, which can assist in planning strategic actions, allocating resources and suggesting hypotheses for new studies in other locations.

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