Cogitare Enfermagem

ORIGINAL ARTICLE

DECREASE OF HOSPITAL INTERVENTION FEES FOR CARDIOVASCULAR DISEASES IN ADULTS IN BRAZIL

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ABSTRACT

Objective: to analyze the trend of hospitalization rates for cardiovascular diseases in adults in Brazil. Method: an ecological study, of time series, of hospitalization rates for cardiovascular diseases in adults by sex, age group and region of residence in Brazil from 2005 to 2016. Data from the *Sistema de Informações Hospitalares do Sistema Único de Saúde* (Hospital Information System of the Unified Health System) were used. For trend analysis, polynomial regression models were used.
Results: a downward trend in hospitalization rates for cardiovascular disease was detected across the country, with the Midwest region having the most significant decrease (-21.29 per year). The South region had the highest rates of hospitalization, including ischemic heart and cerebrovascular diseases.
Conclusion: Brazil showed a decreasing trend in hospitalization rates, yet they are still high. The results may have implications on health surveillance actions, especially in regions where hospitalization rates are high.

DESCRIPTORS: Cardiovascular Diseases; Time Series Studies; Hospitalization; Chronic disease; Health Information Systems.

CAÍDA DE LAS TAJAS DE INTERNACION HOSPITALARIA POR ENFERMEDADES CARDIOVASCULARES EN ADULTOS EN BRASIL

RESUMEN:

Objetivo: evaluar la tendencia de las tajas de internación hospitalaria por enfermedades cardiovasculares en adultos en Brasil. Método: estudio ecológico, de series temporales, de las tajas de internación por enfermedades cardiovasculares en adultos considerándose sexo, franja etaria y región de vivienda en Brasil en el periodo de 2005 a 2016. Se utilizaron los datos del Sistema de Informaciones Hospitalarias del Sistema Único de Salud. Para los análisis de tendencia, se emplearon modelos de regresión polinomial. Resultados: hubo tendencia de caída en las tajas de internación por enfermedad cardiovascular en todo el país; sin embargo la región Centro-Este obtuvo la reducción más expresiva (-21,29 al año). La región Sur presentó las mayores tajas de internación, incluso por enfermedades isquémicas del corazón y cerebrovasculares. Conclusión: Brasil presenta tendencia decreciente en las tajas de internación, pero todavía son altas. Los resultados pueden repercutir en las acciones de vigilancia en salud, en especial en regiones cuyas tajas de internación se muestran elevadas.
DESCRIPTORES: Enfermedades Cardiovasculares; Estudios de Series Temporales; Hospitalización; Enfermedad Crónica; Sistemas de Información en Salud.

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INTRODUCTION

The onset of cardiovascular diseases (CVD) is directly associated with some risk factors, such as age, genetic factors, smoking, obesity, lack of physical activity, poor nutrition, alcohol abuse, and Systemic Arterial Hypertension (SAH)[1]. Investing in actions to promote and prevent lifestyle changes is crucial, since most of the risk factors for the onset of CVD are subject to change, and Brazilian studies have found a high prevalence of these factors in the young and adult population[2].

Worldwide, CVDs have been decreasing, though, due to population growth, lifestyle and aging, they still stand out in the framework of morbidity and mortality, especially ischemic heart diseases (IHD) and cerebrovascular diseases (CbVD)[3] . In Portugal, IHDs were accountable for 4,688 deaths in 2014 and 2.4% of all years lost due to disabilities[4]. In South Korea, in 2015, CVD was the second leading cause of death in the country, with 32,964 deaths in men and 37,848 in women, a mortality rate of 63.6% and 72.2% respectively[5].

Brazil has a similar scenario since CVDs ranks fourth position in the causes of hospital admissions. CVDs have negative burdens that affect the individual, family and society, as they result in sequelae that reduce the quality of life, increase health care expenses, as well as leading to work activities leave[6].

In this study, we sought to verify the manifestation of CVD using hospitalization rates in adults. It is known that such injuries reach alarming proportions, even among adults of working age; understanding the behavior of CVDs in the population makes it possible to investigate gaps in health care for the control of these diseases, and hospitalizations are important indicators for understanding their impact for regions that need more powerful interventions. They can also subsidize the planning of nursing interventions for coping with CVD, from Primary Health Care to Hospital Care, to seek health education actions, the link with the population and individuals' comprehensive health care.

In this scenario, recognizing the importance of preventing diseases that represent high rates of morbidity and mortality in the country, and given the high costs that these grievances cause to the health system, this study aimed to analyze the trend of hospitalization rates by cardiovascular diseases in adults in Brazil.

METHOD

This is an ecological study, of time series with data on hospital admissions for cardiovascular diseases in adults in Brazil. Brazil is composed of 26 federative units and the Federal District, which are distributed in five major regions: North, Northeast, Southeast, South and Midwest. For this study, the Federal District was analyzed together with the Midwest region.

The information comes from the Autorização de Internação Hospitalar (AIH) (Hospitalization Authorization), which has information about the diagnosis and procedures performed during hospitalization, which is processed and, from there, reports are sent to the *Sistema de Informações Hospitalares do Sistema Único de Saúde* (SIH/SUS) (Hospital Information System of the System Unified Health System)[7]. The SIH/SUS is an important tool for assessing the quality of health strategies aimed at the population, also allowing the creation and monitoring of the hospital morbidity and mortality profile, directing health promotion and prevention actions to a distinct population and monitoring the performance of hospital services[8].

The records of hospital admissions for diseases of the circulatory system, available in the Hospital Information System of the Unified Health System (SIH/SUS), from 2005 to 2016, of people aged from 20 to 59 years were analyzed. The choice of the study period corroborated the implementation of the National Health Promotion Policy in 2006, whose objective was to promote quality of life, reduce vulnerability and health risks[9]. It was then decided to establish 2005 as the starting point, up to 2016, the last year available in the database at the beginning of data collection, totaling 12 years.

The data were selected through the list of morbidities of the International Classification of Diseases, in its 10th Revision (ICD-10), referring to chapter IX (Cardiovascular Diseases - CVD, Ischemic Heart Diseases - IHD and Cerebrovascular Diseases - CbVD), selecting hospitalizations for adults from 20 to 59 years old (20-29, 30-39, 40-49 and 50-59 years old), of both sexes. Data collection took place in May 2017; initially, the data extracted from SIH/SUS were double typed in the Microsoft Office Excel 2007 spreadsheet, then the statistical analysis procedures were performed with the aid of the Statistical Package for Social Sciences (SPSS) software, version 20.0.

For the calculation of hospitalization rates, the ratio between the number of hospital admissions for cardiovascular diseases in adults, by the adult population corresponding to the same period, multiplied by 100,000 inhabitants was made. Hospitalization rates were calculated annually for the three groups: total CVD, IHD and CbVD.

The trend analysis of hospitalization rates took place through the application of the polynomial regression model. Hospitalization rates were considered as the dependent variable (Y) and years of study as the independent variable (X). Time series were smoothed using a three-point moving average. Linear ($y=\beta_0+\beta_1 x_1$), quadratic ($y=\beta_0+\beta_1 x_1+\beta_2 x_2$), and cubic ($y=\beta_0+\beta_1 x_1+\beta_2 x_2+\beta_3 x_3$) models were tested, when necessary. The models that presented statistical significance, with better determination coefficient and residual without dependency, were considered as the best polynomial model. In the case that two models are similar, the lowest order was selected, always opting for the simplest model. The significance level was set at 5%.

This study waived an ethical analysis by the Standing Committee for Ethics in Research Involving Human Beings, under opinion no. 18/2016, since the information was retrieved from a public domain database, without the possibility of personal identification.

RESULTS

A total of 5,710,607 hospitalizations due to CVD, from adults living in Brazil, from 2005 to 2016 were analyzed. Of the total hospitalizations, 20.27% (n=1,157,540) were diagnosed with IHD and 13.31% (n=760,082) the CbVD. It was observed that the CVD hospitalization rate in Brazil went from 516.4 hospitalizations/100 thousand inhabitants in 2005, to 376.1 hospitalizations/100 thousand inhabitants in 2016.

The South region showed the highest rate of hospitalization due to CVD (670.6 hospitalizations/100 thousand inhabitants in 2005 and 542.7 hospitalizations/100 thousand inhabitants in 2016), CbVD (85.3 hospitalizations/100 thousand inhabitants in 2005 and 72,9 hospitalizations/100 thousand inhabitants in 2016) and IHD (153.5 hospitalizations/100 thousand inhabitants in 2005 and 159.3 hospitalizations/100 thousand inhabitants in 2016), with the last one showing an average increase of 3.77%. It was found that the Midwest region showed the greatest average decrease in the hospitalization rate due to CVD, going from 666.6 hospitalization 100 thousand inhabitants to 336.8 hospitalizations/100 thousand inhabitants, which means a drop of 49, 47% (Figure 1).
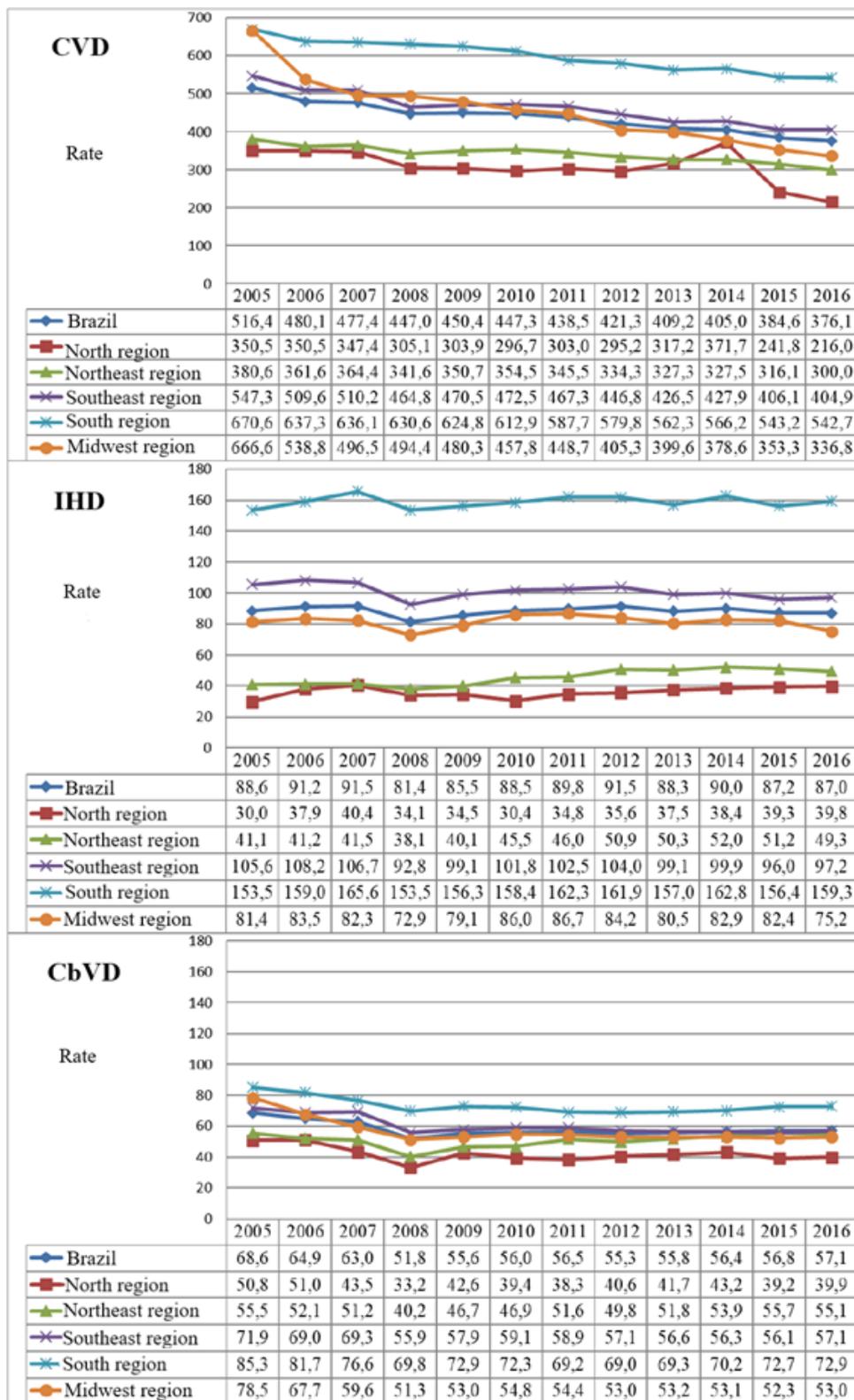
Figure 1 - Hospitalization rates due to cardiovascular diseases in adults in Brazil, from 2005 to 2016. Maringá, PR, Brazil, 2017

In the trend analysis, a decrease in CVD hospitalization rates was detected throughout Brazil, with an average decrease of 10.37 per year (r²=0.98, p=<0.001). The Midwest region had an average of 21.29 per year (r²=0.98, p=<0.001), the most significant decrease among Brazilian regions (Table 1).

Table 1 - Trend in hospitalization rates for cardiovascular diseases in adults in Brazil from 2005 to 2016. Maringá, PR, Brazil, 2017

Region	Model	R2	p	Trend *
Cardiovascular diseases				
Brazil	y=436.01 – 10.37x	0.98	<0.001	↓
North region	y=307.93 – 9.11x	0.87	<0.001	↓
Northeast region	y=345.07 – 5.29x	0.95	<0.001	↓
Southeast region	y=466.96 – 11.05x	0.97	<0.001	↓
South region	y=604.87 – 11.37x	0.99	<0.001	↓
Midwest region	y=459.68 – 21.29x	0.98	<0.001	↓
Ischemic Heart Diseases				
Brazil	$y=87.42+1.16x+0.16x^2-0.08x^3$	0.68	0.019	↓/↑/↓
North region	y=35.90 + 0.29x	0.16	0.246	-
Northeast region	y=44.87 + 1.49x	0.89	<0.001	↑
Southeast region	y=101.24 -0.55x	0.36	0.068	-
South region	y=159.16 + 0.13x	0.09	0.405	-
Midwest region	y=81.64 + 0.20x	0.07	0.471	-
Cerebrovascular Diseases				
Brazil	$y=55.40 – 0.91x +0.28x^2$	0.77	0.002	↓/↑
North region	$y=39.43 – 0.63x +0.27x^2$	0.62	0.022	↓
Northeast region	$y=46.93+1.50x+0.40x^2-0,08x^3$	0.91	<0.001	↓/↑
Southeast region	y=60.36 – 1.23x	0.71	0.002	↓
South region	$y=70.50 – 1.20x + 0.31x^2$	0.95	<0.001	↓/↑
Midwest region	y=56.05 – 1.12x	0.51	0.020	↓

* ↓ Downward; ↑ Upward; ↓/↑ Downward/Upward.

Hospitalizations due to IHD showed an upward trend, however, at the end of the analyzed period, there was a slight average reduction of -0.08 per year (r²=0.68, p=0.019). The Northeast region was the only one that showed an upward trend, with an average annual increase of 1.49 (r²=0.89, p=<0.001), the others showed constant hospitalization rates (Table 1).

As for CbVD, a decreasing trend was found in most years, with a slight average increase of 0.28 (r²=0.77, p=0.002) in the entire Brazilian territory at the end of the analyzed period. In the regional aspects, Northeast and South showed third and second order models respectively, initially with a decreasing trend and, later, increasing. The Southeast showed a significant decrease when compared to other regions, with an average hospitalization rate of 1.23 per year (r²=0.71, p=0.002) (Table 1).

In the analysis by age groups and by quadrenniums, an exponential increase in the number of hospitalizations for CVD was evidenced with aging, with individuals in the age group from 50 to 59 years showing the highest rate of hospitalizations for all diseases (Figure 2).
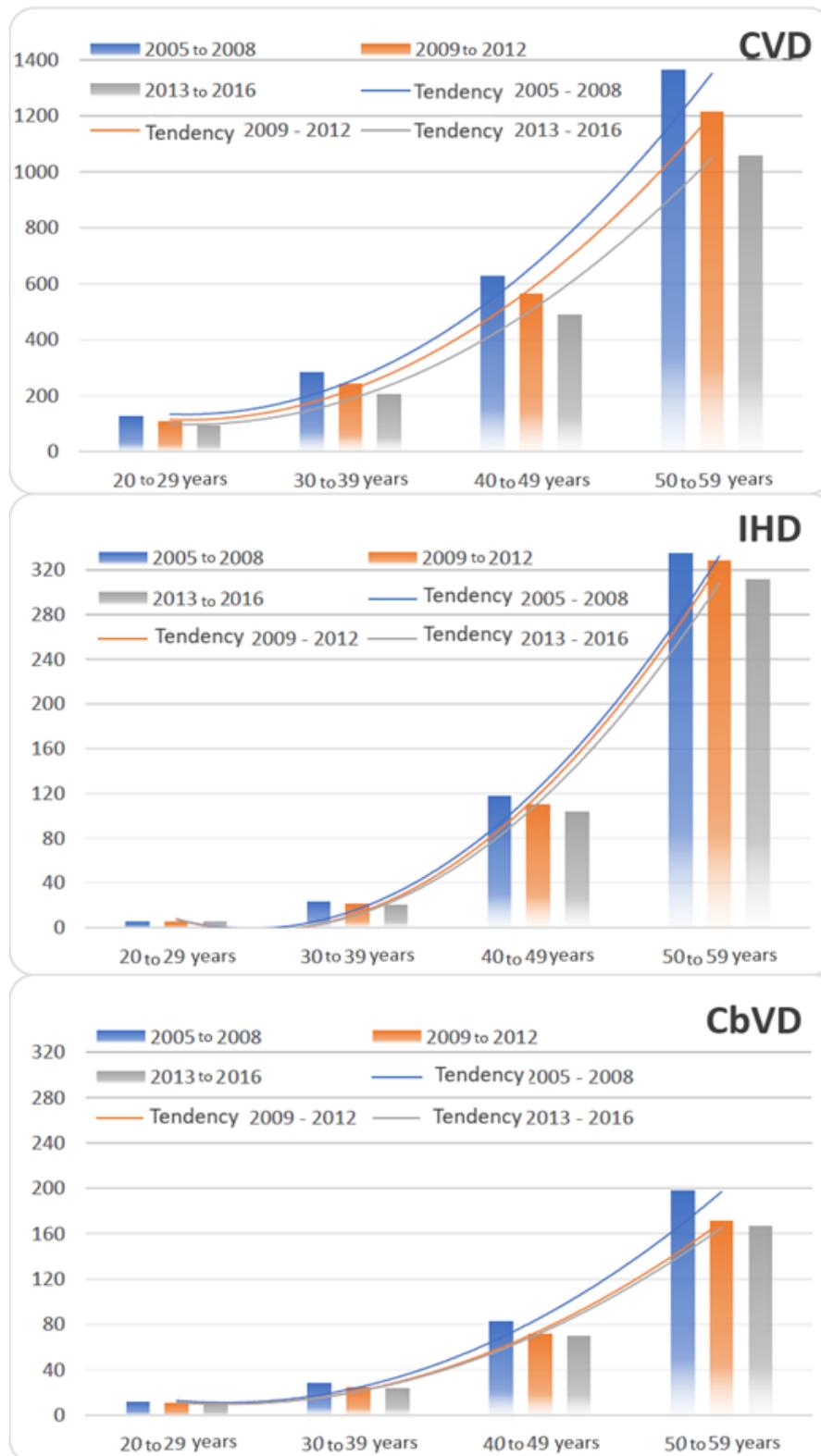
Figure 2 - Hospitalization rates due to cardiovascular diseases in adults, according to age group in Brazil, from 2005 to 2016. Maringá, PR, Brazil, 2017

It was observed that in both sexes there was a decreasing trend in the rates of hospitalization due to CVD in all Brazilian regions, however in the female sex there was a more expressive decrease (Brazil, -11.40, r^2=0.98, p=0.001). As for IHD, a downward/upward/downward trend was identified in the three analyzed quadrenniums for hospitalizations for men and women in the country. Differences were found between the regions: Northeast and Midwest showed an increasing trend in both sexes, with a higher average hospitalization

rate among men (+2.23 and +1.50, respectively). Concerning CbVD, the Southeast region stands out, whose hospitalization rates have shown to be decreasing, and for males the average decrease per year was 1.75 (r^2=0.73, p=0.002) and for the female, 0.73 (r^2=0.64, p=0.005) (Table 2).

Table 2 - Analysis of the trend in hospitalization rates from 2005 to 2016, due to cardiovascular diseases in adults, according to sex. Maringá, PR, Brazil, 2017

	Male				Female			
Region	Model	R2	p	Trend	Model	R2	p	Trend
Cardiovascular diseases								
Brazil	$y=431.68 – 9.46x$	0,98	<0,001	↓	$y=452,54 – 11,40x$	0,98	<0,001	↓
North	$y=288.62 – 8.11x$	0,96	<0,001	↓	$y=328,03 – 10,19x$	0,71	0,002	↓
Northeast	$y=324.51 – 2.18x$	0,76	0,001	↓	$y=364,90 – 8,32x$	0,97	<0,001	↓
Southeast	$y=467.78 – 12.22x$	0,97	<0,001	↓	$y=466,16 – 9,90x$	0,95	<0,001	↓
South	$y=587.11 – 9.07x$	0,98	<0,001	↓	$y=622,40 – 13,63x$	0,98	<0,001	↓
Midwest	$y=441.26 – 18.02x$	0,98	<0,001	↓	$y=477,87 – 24,52x$	0,97	<0,001	↓
Ischemic heart disease								
Brazil	$y=113.09+1.53x+0.17x2-0.09x3$	0,7	0,016	↓/↑/↓	$y=62,25+0,79x+0,15x^2-0,07x^3$	0,75	0,01	↓/↑/↓
North	$y=45.76 +0.37x+0,32x2$	0,85	0,001	↓/↑	$y=22,99 - 0,11x$	0,06	0,506	-
Northeast	$y=55.71+2.23x$	0,92	<0,001	↑	$y=34,42+0,78x$	0,79	0,001	↑
Southeast	$y=134.09-0.09x$	0,44	0,038	↓	$y=67,86+0,76x +0,20x^2-0,09x^3$	0,74	0,011	↓/↑/↓
South	$y=200.75 +0.23x$	0,18	0,218	-	$y=118,10 + 0,01x$	0,01	0,932	-
Midwest	$y=100.15 + 1.50x$	0,76	0,001	↑	$y=63,33 – 1,07x$	0,68	0,003	↓
Cerebrovascular Diseases								
Brazil	$y=58,58-1,23x+0,33x^2$	0,8	0,001	↓/↑	$y=52,28-0,60x+0,23x^2$	0,71	0,005	↓/↑
North	$y=40,82-0,77x+0,30x^2$	0,68	0,007	↓/↑	$y=37,38+0,71x +0,34x^2-0,09x^3$	0,89	0,001	↓/↑/↓
Northeast	$y=49,25+0,66x+0,26x^2$	0,76	0,003	↓/↑	$y=45,21+1,32x +0,43x^2-0,09x^3$	0,9	0,001	↓/↑
Southeast	$y=65,45-1,75x$	0,73	0,002	↓	$y=55,40-0,73x$	0,64	0,005	↓
South	$y=74,12-1,60x+0,35x^2$	0,96	<0,001	↓/↑	$y=66,93-0,79x+0,25x^2$	0,9	<0,001	↓/↑
Midwest	$y=55.60-2.18x+0.49x^2$	0.83	0.001	↓	$y=52.62-0.54x$	0.33	0.080	-

↑ Upward; ↓ Downward; - Constant; ↑/↓ Upward / Downward; ↓/↑/↓ Downward/Upward /Downward.

DISCUSSION

The study enabled to analyze the trend in hospitalization rates due to CVD throughout the Brazilian territory over 12 years, divided into quadrenniums. The data showed a drop in hospitalizations of adults, with variations among regions, age group and sex. The findings are similar to those found by the Global Disease Burden Study, which identified that, from 1990 to 2013, the mortality rate due to CVD decreased by about 22% and there was a one-fifth reduction in the mortality rate due to IHD and stroke, which can impact the number of hospitalizations[10].

Opposing to this study's findings, research conducted from 2001 to 2015, in a region of Spain, identified an increasing trend in hospitalizations for acute cardiovascular diseases, whereas, for mortality, the trend was shown to be decreasing, emphasizing the effects of assigned prevention measures[11]. Still, a cross-sectional study carried out in the United States of America, with 40,082 hospitalizations for primary diagnosis of ischemic stroke, from 2010 to 2012, found that 41.5% of hospitalizations were of subjects from 18 to 54 years old, with 43% having recurrent hospital readmissions and 25.6% of cases occurred in association with atrial fibrillation[12].

In Brazil, a study found that, from 2010 to 2015, there was a decrease in clinical hospitalizations due to CVD, however, surgical hospitalizations had an increase of 55%, mainly related to vascular surgeries and coronary angioplasty[13]. Thus, given the magnitude and potential of morbidity and mortality that chronic non-communicable diseases (NCDs) represent, especially CVDs, the World Health Organization (WHO) proposed a 25% decrease in NCDs by the year 2025, and reinforced the importance of direct intervention on the prevention of the most prevalent risk factors, with the need for well-conducted programs and primary and secondary prevention actions for the early CVD diagnosis and treatment[14].

In adherence to this proposed goal, the Ministério da Saúde (MS) (Ministry of Health), in partnership with other ministries and institutions, prepared the Plano de Ações Estratégicas para o Enfrentamento das DCNT no Brasil (Strategic Action Plan for Coping NCDs in Brazil), from 2011 to 2022, to create and implement effective public policies actions aimed at the prevention and control of NCDs, based on surveillance, health promotion and comprehensive care, to prepare Brazil to confront NCDs[15].

It is assumed that the downward trend in hospitalizations in Brazil is related to policies that have been implemented over the years. It can be highlighted the *Política Nacional de Promoção da Saúde* (PNPS) (National Health Promotion Policy), which reinforces the obligations of each domain of government and the active participation of the subject in health care in the mobilization for healthy eating, physical activity, coping with alcohol abuse and smoking cessation[16].

In this study, the Midwest was the region that showed a downward trend in hospitalization rates when compared to other Brazilian regions. Another study, which analyzed the trend of hospitalizations due to NCDs in the years 2002 to 2012, showed stability for CVD hospitalization rates in Brazil, for all regions, except for the Midwest region, which was the only one that showed a substantial decline in the period, with an annual rate of change of -8.78%[17]. In comparison to this study, hospital admissions for CVD showed a drop when compared to previous years, and the Midwest region stands out compared to the others.

However, the expressive rates of hospitalization due to CVD, found in the South, may be related to the greater number of hospital beds, since this region has the highest rate of beds per inhabitant in Brazil[18]. Another study also showed a higher prevalence of hospitalizations for IHD and CbVD in the South[3].

In Paraná, the regions with the best coverage in the Estratégia Saúde da Família (ESF) (Family Health Strategy) correlated with the decrease in the number of hospital admissions due to CVD. It is noteworthy that, currently, the region with the best coverage of the ESF is the Northeast (84.16%), followed by the North (68.59%), South (68.36%), Midwest (62, 93%) and Southeast (58.45%)[19].

In the general analysis of the present study, it is observed that the South region has the second-best coverage of ESF in the country. However, the highest hospitalization rates were found, highlighting that the Midwest region showed a greater decrease in hospitalizations due to CVD, and it is the region with the lowest percentage of ESF coverage.

The higher prevalence of hospital admissions for males confirms results found in a study carried out in Northeastern Spain, in which the male population had 70% of admissions, mainly due to AMI (Acute Myocardial Infarction) and under the age of 46 years[20].

In Brazil, a study carried out in the capital of Mato Grosso showed that men were more likely to have two or more risk factors for CVD and that this increase is directly associated with age and low education[21]. Other studies carried out in Brazil[22-23] also found that men are more likely to have two or more risk factors for CVD. In the international literature, a study carried out in the province of Jilin, China[24] and among Hispanic/Latino Americans of different origins[20], demonstrated the same result. However, in some studies, no substantial differences were found regarding the number of cardiovascular risk factors by sex[25-26].

Therefore, even though there has been a general trend towards a decrease in CVD, the prevention, reduction and control of these diseases should be strengthened. The most exciting task that can be linked to the reduction of CVD is already well defined and consists of the reduction of risk factors in the population, which can be facilitated through health education. This implies, above all, the co-responsibility between the individual and health services with health promotion, which, in a way, is related to the right of access to quality health, to effective preventive measures that provide subsidies for coping with diseases already settled and preventing future morbidities and injuries.

Among the limitations of the study, we emphasize that SIH/SUS may be underreported in some locations, due to decentralization. Furthermore, AIHs are documents that may contain flaws in writing and typing, including flaws in the diagnosis. Another limitation is the fact that the system only includes admissions financed by SUS, therefore, this study does not cover admissions from private systems and health plans.

CONCLUSION

There was a downward trend in rates of hospitalizations for CVD in Brazil, with variations in terms of IHD and CbVD, and according to sex. The Midwest region presented the largest average annual decrease in the period. On the other hand, the South region of the country had the highest hospitalization rates for the three disease groups, which indicates that further studies must be carried out to identify the factors associated with the high rates of hospitalization for diseases of the circulatory system in this region.

The results of this study may have repercussions on health surveillance actions, by supporting the performance of nurses, who are present at all levels of health care and work in an interdisciplinary way, encouraging self-care and changing risk factors that can be improved through health education and psychoeducational strategies. These, through coping, help health promotion and disease prevention, especially in regions whose hospitalization rates are high, with an increasing trend and/or have attributes that make the population vulnerable.

ACKNOWLEDGEMENTS

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