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RESEARCH ARTICLE (ORIGINAL)

Hospitalizations due to arterial hypertension and Family Health Strategy coverage: Brazil, 2010 to 2019

Internamentos por hipertensão arterial e cobertura da Estratégia Saúde da Família: Brasil, 2010 a 2019

Hospitalizaciones por hipertensión arterial y cobertura de la Estrategia de Salud Familiar: Brasil, de 2010 a 2019

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Abstract

Background: Systemic arterial hypertension (SAH) is a cardiovascular disease (CVD) that can lead to hospitalization. In Brazil, SAH-related hospitalizations fall within the Family Health Strategy (FHS) scope, whose work deals with chronic conditions such as SAH.

Objectives: To analyze the trend of hospitalization rates and examine the relationship between hospitalization rates and the FHS coverage in Brazil from 2010 to 2019.

Methodology: This is an ecological time-series study, with data from the Hospital Information System of the Brazilian National Unified Health System (SIH-SUS), from 2010 to 2019. The Prais-Winsten regression and the Pearson correlation were used.

Results: A total of 793,198 hospitalizations were recorded during the period analyzed. The hospitalization rate declined from 58.7 to 29.6/100,000 residents, with an annual variation of -16.3% ($CI_{95\%}$ -21.8; -10.9).

Conclusion: The correlation between hospitalization rates and the FHS coverage was high and inversely proportional (-0.98). The hospitalization rates followed a downward trend, possibly reflecting the improvement of care and access to FHS services.

Keywords: hypertension; hospitalization; health information systems; time-series studies; family health strategy

Resumo

Enquadramento: A hipertensão arterial sistémica (HAS) é uma doença cardiovascular (DCV) que desencadeia internamento hospitalar. No Brasil, os internamentos por HAS são considerados sensíveis à atuação da Estratégia Saúde da Família (ESF), que organiza os seus processos de trabalho para o enfrentamento das condições crónicas, como a HAS.

Objetivos: Analisar a tendência das taxas de internamento e verificar a relação entre as taxas de internamento e a cobertura da ESF no Brasil, de 2010 a 2019.

Metodologia: Estudo ecológico de séries temporais, com dados do Sistema de Informações Hospitalares do Sistema Único de Saúde (SIH-SUS), de 2010 a 2019. Recorreu-se a regressão de Prais-Winsten e correlação de Pearson.

Resultados: No período foram registados 793.198 internamentos. A taxa de internamento declinou de 58,7 para 29,6/100.000 habitantes, com variação anual de -16,3% ($IC_{95\%}$ -21,8; -10,9).

Conclusão: A correlação entre as taxas de internamento e a cobertura da ESF foi muito alta e inversamente proporcional (-0,98). As taxas de internamento seguiram tendência decrescente, o que pode refletir a melhoria do cuidado e do acesso aos serviços da ESF.

Palavras-chave: hipertensão; hospitalização; sistemas de informação em saúde; estudos de séries temporais; estratégia saúde da família

Resumen

Marco contextual: La hipertensión arterial sistémica (HAS) es una enfermedad cardiovascular (DCV, en portugués) que conlleva una hospitalización. En Brasil, los ingresos hospitalarios por HAS se consideran susceptibles al desempeño de la Estrategia de Salud Familiar (ESF), que organiza sus procesos de trabajo para hacer frente a las afecciones crónicas, como la HAS.

Objetivos: Analizar la tendencia de las tasas de hospitalización y verificar la relación entre las tasas de hospitalización y la cobertura de la ESF en Brasil, de 2010 a 2019.

Metodología: Estudio ecológico de series temporales, con datos del Sistema de Información Hospitalaria del Sistema Único de Salud (SIH-SUS), de 2010 a 2019. Se emplearon la regresión de Prais-Winsten y la correlación de Pearson.

Resultados: En el periodo se registraron 793.198 ingresos. La tasa de hospitalización disminuyó de 58,7 a 29,6/100.000 habitantes, con una variación anual de -16,3% ($IC_{95\%}$ -21,8; -10,9).

Conclusión: La correlación entre las tasas de hospitalización y la cobertura de la ESF fue muy alta e inversamente proporcional (-0,98). Las tasas de hospitalización siguieron una tendencia a la baja, lo que puede reflejar la mejora de la atención y el acceso a los servicios de la ESF.

Palabras clave: hipertensión; hospitalización; sistemas de información en salud; estudios de series temporales; estrategia de salud familiar

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Introduction

Systemic arterial hypertension (SAH) is a severe cardio-vascular disease (CVD), directly or indirectly responsible for reducing individuals' life expectancy and functional capacity (Barroso et al., 2020). It has often been associated with fatal and non-fatal cardiovascular outcomes and is considered a critical factor in worsening other CVDs (Malachias et al., 2016).

In Brazil, SAH affects approximately 32.5% (36 million) of the adult population and more than 60% of older adults, contributing significantly to increasing the number of CVD-related deaths in both sexes and at all ages (Magalhães et al., 2018).

In 2018 alone, the Brazilian National Unified Health System (SUS) spent more than R$ 2.9 billion in CVD-related health services, the largest amount of expenses among the groups of diseases that trigger hospital admissions (Ministério da Saúde, Departamento de Informática do Sistema Único de Saúde [DATASUS], Sistema de Informações Hospitalares, 2019). These costs arise from the hospital care delivered to the affected individuals and the resources invested due to loss of function and productivity caused by CVDs, particularly SAH (Piuzevam et al., 2015).

The FHS was created to give a new direction to Primary Health Care (PHC) work processes. The aim was to reduce preventable hospitalizations, including those resulting from SAH complications. This way, it would be possible to minimize the costs of specialized and high complexity care in Brazil and improve the quality of life of people living with SAH (Portaria nº 2.436, de 21 de Setembro de 2017 do Ministério da Saúde; Malachias et al., 2016). In Brazil, epidemiological studies addressing the relationship between the trend in hospitalization rates due to SAH and the FHS coverage are scarce. These studies allow examining whether the FHS actions and strategies implemented in recent years and aimed at maintaining hypertensive patients' health and reducing hospitalizations resulting from SAH complications have influenced Brazilian hospitalization rates. This study is relevant because it seeks to analyze the trend of SAH-related hospitalizations and examine the relationship between SAH-related hospitalization rates and FHS coverage in Brazil from 2010 to 2019.

Background

SAH significantly impacts morbidity and mortality, resulting in increasingly frequent hospitalizations, which are costly for health services and impair the quality of life of people living with SAH (Malachias et al., 2016). Classified as a primary care sensitive condition (PCSC), the hospitalizations due to SAH complications reflect the effectiveness of PHC actions, as the FHS's adequate monitoring of hypertensive patients should avoid unnecessary hospitalizations (Santos et al., 2019).

Implemented by multi-professional teams, health managers, and the population, the FHS aims to reduce the effects of socio-economic, demographic, individual, and contextual health inequalities, favoring health care and the adequate control of chronic morbidity and improving quality of life and well-being. These reduce the risks of early death and years lost due to disability resulting from the increase of chronic diseases, such as SAH (Oliveira et al., 2020).

PHC has been organizing its work processes to face the increased prevalence of SAH, observed since 2006, and avoid complications and preventable hospitalizations. It has intensified actions and strategies to meet chronic conditions, particularly SAH, and created screening and follow-up protocols. Among such strategies, the increase in FHS coverage and qualification can be observed throughout the country (Portaria nº 2.436, de 21 de Setembro de 2017 do Ministério da Saúde; Malachias et al., 2016). As a strategy for PHC expansion, qualification, and consolidation in Brazil, the FHS aims to give a new direction to the work processes more likely to deepen the principles, guidelines, and foundations of primary care, expand the response capacity to and the impact on the health status of individuals and groups and provide an important cost-effectiveness ratio (Portaria nº 2.436, de 21 de Setembro de 2017 do Ministério da Saúde).

Hypothesis

The trends in SAH-related hospitalization rates are influenced by FHS coverage in Brazil.

Methodology

This is an ecological time-series study using data on SAH-related hospitalizations in Brazilian states entered into the Hospital Information System of the Brazilian Unified Health System (SIH/SUS). Hospitalizations were identified using the codes "I10" for essential (primary) hypertension and "I11" for hypertensive heart disease, used in the Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10). The hospitalizations referred to the period from 2010 to 2019. Population and hospitalization data were collected through the websites of the Brazilian Institute of Geography and Statistics (IBGE) and the Department of Informatics of the Brazilian Unified Health System (DATASUS) (Ministério da Saúde, Departamento de Informática do Sistema Único de Saúde, Sistema de Informações Hospitalares, 2019), respectively. The Brazilian list of Hospitalizations due to Primary Care Sensitive Conditions (*Internamentos por Condições Sensíveis à Atenção Primária* - ICSAP) was used to determine PCSCs (Alfradique et al., 2009). The research on the FHS coverage in Brazil was carried out on the Brazilian Ministry of Health's Primary Care Information and Management System (E-GESTOR AB) website. The website's information on the percentage of FHS coverage is publicly available and refers to each month and year. The annual mean from 2010 to 2019 was calculated to compare the

SAH-related hospitalization rates during this period. Data on the hospitalizations were collected from the Hospitalization Authorizations (*Autorizações de Internamentos Hospitalar* - AIH) archives, available on Tabnet (DATASUS), in database file (DBF) format. The AIH files were converted and exported to Microsoft Excel spreadsheets (Windows 2010) using TABWIN software to allow data organization and reading. Next, they were grouped into tables to determine absolute and relative frequencies. The hospitalization rates were standardized using the direct method to minimize the influence of the population's age. The standard population was described in the last IBGE Census (IBGE, 2010). The rate calculation was obtained by dividing the total number of SAH-related hospitalizations in each State (Unidade da Federação - UF), geographic region, and Brazil by the resident population in the respective locations, multiplied by 100,000 residents. Thus, the annual percentage change (APC) of hospitalization rates in Brazil was calculated together with the proportion of SAH-related hospitalizations in relation to the ICSAP group and the total number of hospitalizations in Brazil from 2010 to 2019. The Prais-Winsten regression method was used to analyze the trend because it is the most appropriate for data with autocorrelation (Prais & Winsten, 1954; Antunes & Waldman, 2002). In this analysis, the hospitalization rates logarithm was used as the dependent variable and the year of hospitalization as the independent variable. The trend analysis was stratified by geographic region and UF. The value of β relative to the slope was obtained using the Prais-Winsten regression. The statistical significance was stipulated by comparing the *p* value and the value presented in the standard normal curve, with a 95% Confidence Interval ($_{95}$%CI). The coefficient of determination (R^2) was used to adjust the generalized linear statistical model. The R^2 varies between 0 and 1 and indicates, in percentage, the extent to which the model can explain the observed values. Antunes and Waldman's formula was used to calculate the APC: $APC = \alpha + 10\beta$, where α refers to the value of hospitalization rates in the first year of the times series, corresponding to the intersection between the X and Y axes; and β relates to the slope coefficient formed by the regression. The following formula was used to calculate the $_{95}$%CI of the APC in the period under analysis: $_{95}$%CI $= -1 + 10(\beta \pm t * EP)$, where *t* is the value at which the Student's t-distribution has 15 degrees of freedom with a two-sided CI$_{95}$%; and EP is the standard error of the β estimate, established by the regression analysis, depending on the values of the APC and the limits of their $_{95}$%CI The trend was classified as downward (values of the lower and upper limits of the negative $_{95}$%CI), stationary (zero value between the lower and upper limits of the $_{95}$%CI), and upward (values of the lower and upper limits of the positive $_{95}$%CI; Silva et al., 2019).

Pearson's correlation coefficient (r) was used to test the relationship between SAH-related hospitalization rates and FHS coverage, examining the relationship between two quantitative and independent variables with normal distribution. A 5% significance level was adopted (*p* < 0.05) for all statistical tests applied. Statistical analyses were performed in R software (version 3.6.2), and regressions were calculated in the Prais package.

The data used in the study were anonymous and publicly available, which waived the need for submission to the Research Ethics Committee (REC).

Results

From 2010 to 2019, 793,198 hospitalizations due to SAH were authorized in public Brazilian SUS hospital services. This study's results show a reduction in the SAH-related hospitalizations rate in Brazil, which went from 58.7/100,000 residents in 2010 to 29.6/100,000 residents in 2019 (-49.6%), as described in Table 1.

Among the geographic regions, the Central-West region, which had a rate of 74.0/100,000 residents in 2010, had the greatest reduction during the period analyzed (-65.5%), resulting in a rate of 25.5/100,000 residents in 2019. Piauí had the highest hospitalization rate among the Brazilian states in 2010 (192.9/100,000 residents) and showed the greatest reduction (-69.6%) during the period studied, ending the time series with a rate of 58.5/100,000 residents. In the state of Santa Catarina, the hospitalization rate increased from 24.7/100,000 residents in 2010 to 29.1/100,000 residents in 2019 but maintained a stationary trend (APC = 8.1 %; $_{95}$%CI: -27.8; 44.1; *p* = 0.109). The other UF showed a reduction in hospitalization rates in the period under analysis. At the end of the time series (2019), the lowest hospitalization rates were seen in the South and Southeast regions, while the highest rates were seen in the North and Northeast regions (Table 1).

In the present study, the trend analysis indicated declining rates of hospitalization for SAH in Brazil (APC = -16.3 %; $_{95}$%CI: -21.8; -10.9; *p* < 0.001) and in the Northeast (APC: -15.7; $_{95}$%CI: -27.0; -4.4; *p* < 0.001), Southeast (APC: -17.3; $_{95}$%CI: -22.9; -11.7; *p* < 0.001) and Central-West (APC = -23.9 %; $_{95}$%CI: -42.4; -5.5; *p* < 0.001) regions. The Northern (APC: -14.4; $_{95}$%CI: -34.9; 6.0; *p* = 0.010) and Southern (APC: -11.1; $_{95}$%CI: -28.0; 5.7; *p* = 0.010) regions showed a stationary trend. Among the UF, those that showed a decreasing trend were: Piauí (APC = -27.9 %; $_{95}$%CI: -45.4; -10.4; *p* < 0.001); Ceará (APC: -26.8; $_{95}$%CI: -38.7; -15.0; *p* < 0.001), Rio Grande do Norte (APC: -31.6; $_{95}$%CI: -59.3; -3.9; *p* < 0.001), Pernambuco (APC: -19.9; $_{95}$%CI: -30.3; -9.4; *p* < 0.001) and Alagoas (APC: -19.3; $_{95}$%CI: -38.1; -0.4; *p* < 0.001) in the Northeast region; Minas Gerais (APC: -16.4; $_{95}$%CI: -27.4; -5.3; *p* < 0.001) and São Paulo (APC: -18.1; $_{95}$%CI: -24.6; -11.7; *p* < 0.001) in the Southeast region; Rio Grande do Sul (APC: -14.4; $_{95}$%CI: -21.0; -7.9; *p* < 0.001) in the South region; and the Distrito Federal (APC: -16.3; $_{95}$%CI: -21.8; -10.9; *p* < 0.001) in the Central-West region (Table 1).

Table 1

Trends in hospitalization rates (x100,000 residents) due to systemic arterial hypertension per year, according to regions and states, Brazil, 2010-2019

Regions/States	2010	2019	APC[a] (%)	95%CI[b]		p Value*	Trend
				LL	UL		
Brazil	**58.7**	**29.6**	**-16.3**	**-21.8**	**-10.9**	**<0.001**	**Downward**
North	**72.4**	**42.7**	**-14.4**	**-34.9**	**6.0**	**0.010**	**Stationary**
Rondônia	142.0	71.2	-18.9	-45.7	7.9	0.010	Stationary
Acre	46.3	28.9	-11.2	-4.4	17.9	0.050	Stationary
Amazonas	34.2	26.5	-6.9	-27.2	13.2	0.015	Stationary
Roraima	49.2	21.5	-10.9	-95.2	73.3	0.201	Stationary
Pará	80.6	52.0	-12.5	-36.8	11.7	0.030	Stationary
Amapá	35.5	15.8	-27.0	-78.4	24.4	0.010	Stationary
Tocantins	84.7	27.5	-28.8	-65.2	7.4	0.011	Stationary
Northeast	**79.8**	**40.7**	**-15.7**	**-27.0**	**-4.4**	**<0.001**	**Downward**
Maranhão	126.5	119.9	-0.9	-23.6	21.8	0.673	Stationary
Piauí	192.9	58.5	-27.9	-45.4	-10.4	<0.001	Downward
Ceará	46.2	13.6	-26.8	-38.7	-15.0	<0.001	Downward
Rio Grande do Norte	35.3	8.0	-31.6	-59.3	-3.9	<0.001	Downward
Paraíba	89.1	17.6	-33.6	-68.2	1.0	0.010	Stationary
Pernambuco	56.4	23.4	-19.9	-30.3	-9.4	<0.001	Downward
Alagoas	51.6	21.2	-19.3	-38.1	-0.4	<0.001	Downward
Sergipe	30.5	24.8	-4.4	-34.7	25.9	0.081	Stationary
Bahia	88.7	47.2	-15.1	-36.0	5.6	0.010	Stationary
Southeast	**45.9**	**22.3**	**-17.3**	**-22.9**	**-11.7**	**<0.001**	**Downward**
Minas Gerais	37.5	19.0	-16.4	-27.4	-5.3	<0.001	Downward
Espírito Santo	58.5	27.5	-17.1	-46.8	12.6	0.010	Stationary
Rio de Janeiro	43.1	23.2	-14.9	-60.3	30.3	0.020	Stationary
São Paulo	49.9	23.0	-18.1	-24.6	-11.7	<0.001	Downward
South	**39.6**	**24.1**	**-11.1**	**-28.0**	**5.7**	**0.010**	**Stationary**
Paraná	50.1	24.5	-16.6	-46.1	12.8	0.020	Stationary
Santa Catarina	24.7	29.1	8.1	-27.8	44.1	0.109	Stationary
Rio Grande do Sul	38.0	20.6	-14.4	-21.0	-7.9	<0.001	Downward
Central-West	**74.0**	**25.5**	**-23.9**	**-42.4**	**-5.5**	**<0.001**	**Downward**
Mato Grosso do Sul	66.6	25.3	-20.0	-48.7	8.6	0.012	Stationary
Mato Grosso	59.7	23.4	-22.0	-49.7	5.6	0.010	Stationary
Goiás	51.3	28.7	-16.9	-65.3	31.5	0.030	Stationary
Federal District	58.7	29.6	-16.3	-21.8	-10.9	<0.001	Downward

*Note.* LL: lower limit; UL: upper limit
[a] Annual Percent Change
[b] 95% Confidence Interval
* Prais Winsten Regression

This study demonstrated that the decrease in SAH-related hospitalization rates in Brazil from 2010 to 2019 was correlated with the increase in the FHS coverage (Figure 1).

Figure 1

Correlation[a] between hospitalization rates due to systemic arterial hypertension and the Family Health Strategy coverage, Brazil, 2010 to 2019
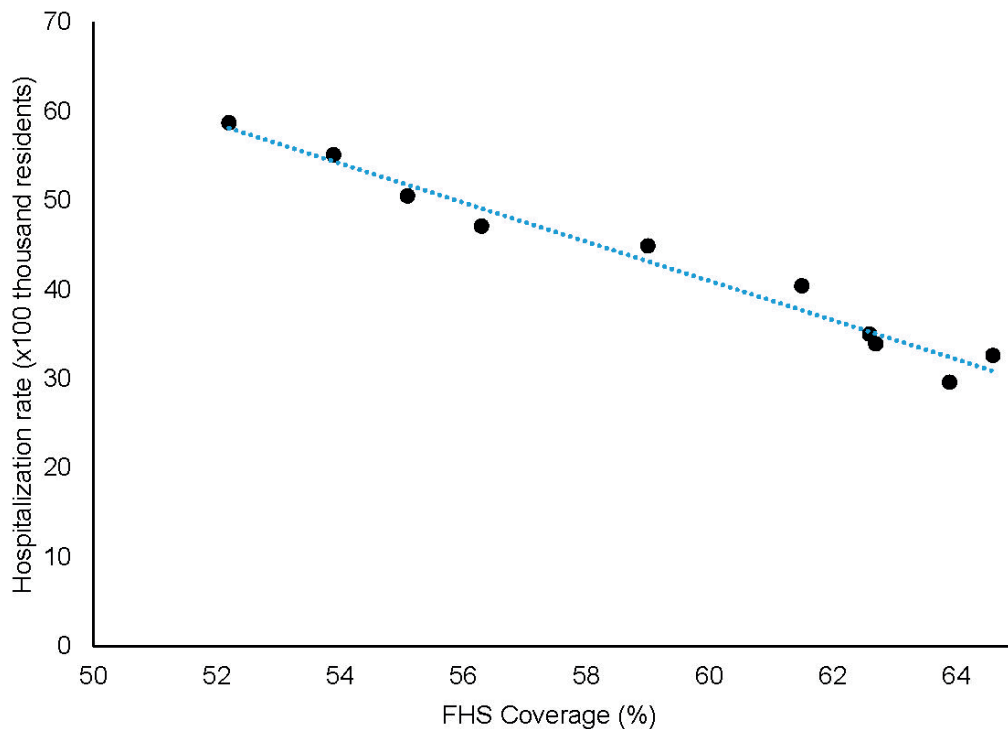
[a] Pearson's Correlation; $R^2 = -0.968$; *p* value < 0.01.

In the period studied, the proportion of SAH-related hospitalizations decreased by 34.4% in relation to the total number of ICSAP and 55.5% compared to the total number of all-cause hospitalizations recorded in the SIH/SUS (Table 2).

Table 2

Hospitalization rate and proportion of SAH-related hospitalizations compared to ICSAP and the total number of hospitalizations, Brazil, 2010 to 2019

Year	Hospitalization rate[a]	Proportion of ICSAP (%) [b]	Proportion of the total number of hospitalizations (%) [c]
2010	58.7	3.9	0.9
2011	55.1	3.6	0.9
2012	50.5	3.8	0.8
2013	47.1	3.4	0.8
2014	44.9	3.2	0.7
2015	40.4	3.1	0.6
2016	35.0	2.9	0.5
2017	33.9	2.7	0.5
2018	32.6	2.6	0.5
2019	29.6	2.5	0.4
(2010-2019)	-49.6	-34.4	-55.5

[a] Hospitalization rate due to arterial hypertension x 100,000 inhabitants.
[b] Proportion of hospitalizations due to SAH compared to ICSAP.
[c] Proportion of hospitalizations due to SAH compared to the total number of hospitalizations.
Source: Brazilian Health Ministry, Secretariat of Health Surveillance, Hospital Information System of the Brazilian Unified Health System (SIH/SUS).

Discussion

The reduction in Brazilian SAH-related hospitalization rates and trends can relate to the improvement in PCS-Cs quality of care and access, shown by the increased percentage of FHS coverage in Brazil as of 2010 (Santos et al., 2019).

Moreover, the expansion of the FHS coverage and the establishment of policies, protocols, and strategies, such as the creation of the PCSC list, among other objectives, aim to prevent hospitalizations through the effectiveness of PHC. These actions directly influenced the reduction of SAH-related hospitalizations in Brazil, as PHC can resolve up to 80% of PCSCs (Malachias et al., 2016; Malta et al., 2017; Santos et al., 2019).

Hospitalization rates varied across geographic regions. The heterogeneous occurrence and distribution of chronic noncommunicable diseases (NCDs) in the population result from complex processes. These are determined by social, economic, cultural, environmental, political, and individual factors, such as sociodemographic characteristics and behavioral factors (World Health Organization [WHO], 2010). Moreover, the characteristics of services, including health professionals and physical infrastructures, in the Brazilian municipalities can facilitate or hinder users' experience and impact the quality and effectiveness of SAH care. This may also explain the higher occurrence of hospitalizations observed in some municipalities (Oliveira et al., 2020).

Several studies point out that social determinants of health (SDH) also influence the distribution of hospital admissions. SDH individual factors, such as smoking habits, sedentary lifestyle, and poor diet, are essential to determine which individuals in a given group are exposed to a higher risk. The differences in health levels of groups, regions, and countries are mainly associated with the distribution of income and education, whose levels also influence individual factors (Carrapato et al., 2017; Oliveira et al., 2015).

In Brazil, the North and Northeast regions stand out as the places whose populations have the lowest income and education levels and, consequently, the most vulnerable groups affected by NCDs, such as SAH (Albuquerque et al., 2017). This situation may result from these regions' differences in socio-economic conditions and SDH, as Brazil has considerable regional inequalities resulting from historical heritage. The lowest levels of socio-economic development and the lowest FHS coverage in the country are in the North and Northeast regions, which directly or indirectly contribute to the occurrence of hospitalizations due to SAH (Albuquerque et al., 2017; Oliveira et al., 2020).

The FHS actions positively impact the hypertensive patients' quality of life through its regular monitoring and the improved access to other health services, thus reducing the risks of early death, the years lost due to disability, and, consequently, the SAH-related hospitalization rates (Oliveira et al., 2020).

Health managers should strengthen PHC, strive to reduce the growth of chronic NCDs, such as SAH, and, con-sequently, avoid hospitalizations and premature deaths due to its complications (WHO, 2018).

The downward trend of Brazilian SAH-related hospitalization rates reinforces the idea that the expansion of FHS actions and improved access to PHC services result from expanding FHS coverage, which impacts the lives and health of users accompanied by family health teams, as is the case of SAH patients (Malachias et al., 2016; Rodrigues et al., 2019).

Moreover, the reduction in the SAH-related hospitalization rate in Brazil by 49.6% from 2010 to 2019 supports the improvement of FHS actions. In this same period, the proportion of SAH-related hospitalizations decreased by 34.4% compared to the total number of ICSAP and 55.5% in relation to the total number of all-cause hospitalizations recorded in SIH/SUS.

Despite the decrease in hospitalization rates observed in the present study, the prevalence of SAH has been increasing in Brazil. It is still considered one of the leading causes of CVD hospitalizations in health services (Silva et al., 2019).

It is also worth noting that, in recent years, despite the improvement in PHC quality (Barroso et al., 2020; Santos et al., 2019), measures, such as the SUS budget freeze, may have future impacts reflected in the occurrence and control of NCDs, such as SAH. Countries that invest in quality PHC positively impact their populations' health and, consequently, people live longer and better. In this scenario, PHC is necessary to optimize system costs and organize patient flows between different health services (Malta et al., 2017).

This study has limitations. The use of secondary databases, subject to the lack of standardization in data collection, may affect the quality of the data recorded (information bias). The rates were calculated based on the number of hospitalizations compared to the resident population and referred only to the SUS user population, covering 70% to 80% of Brazilian people. Therefore, this study's results should be evaluated with the caution needed when interpreting the findings of ecological studies. Despite the limitations, this study's results are relevant as they indirectly assess the impact of PHC services access in reducing SAH-related hospitalizations in Brazil.

Conclusion

The downward trend in Brazilian SAH-related hospitalization rates appears to be influenced by the increased coverage of FHS. It seems to reflect the improvement of multidisciplinary teams' care delivery, the population's awareness of health care, and health managers' more significant commitment to expand access to PHC services in Brazil. However, despite this, in some states, the trend remains stationary. Inversely proportional to FHS coverage, the SAH-related hospitalization rates decreased. Nevertheless, PHC services still need to intensity health promotion actions involving the prevention of SAH and its complications, and focus on the most vulnerable groups, in this case, women and older adults.

This study's results can support the modification, maintenance, or intensification of SAH preventive actions and care, particularly in the states that did not significantly reduce their rates. Therefore, it is necessary to assess other factors associated with this lack of reduction.

Authors contributions

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Writing - revision and editing: Oliveira, E. F., Neto, A. Q., Rodrigues, M. T., Mascarenhas, M. D.

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