



ORIGINAL ARTICLE

Trend of hospitalizations for ambulatory care sensitive conditions and related aspects in Sergipe, 2010 to 2019.

Tendência das internações por condições sensíveis à atenção primária e aspectos relacionados em Sergipe, 2010 a 2019.

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KEYWORDS

Family health
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ABSTRACT

Objective: To analyze the trend of hospitalization rates for ambulatory care-sensitive conditions (HACSC) in Sergipe and its seven health regions between 2010 and 2019, correlating with financial investments in health and primary care, strategy coverage of family health, and the number of hospital beds.

Methods: This is an ecological time-series study trend with secondary data from the Ministry of Health. The trend verification was done by segmented linear analysis and the correlation between the variables by Spearman's correlation.

Results: HACSC in the state of Sergipe showed a trend towards stability. In the Nossa Senhora do Socorro region, an increasing rate trend was identified from 2010 to 2017 and a non-significant decreasing trend from 2017 to 2019, with a negative correlation with per capita investment in PHC. The Itabaiana region showed a trend of reduction in rates from 2010 to 2012, followed by a trend of growth in rates from 2012 to 2020, with no significant correlation with any of the variables.

Conclusions: Monitoring HACSC rates and understanding their multifactorial influence are essential since this indicator is helpful in local situational diagnosis and contributes to planning actions.

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PALAVRAS-CHAVE

Atenção primária à saúde
 Financiamento da assistência à saúde
 Hospitalização
 Qualidade da assistência à saúde
 Saúde da família

RESUMO

Objetivo: Analisar a tendência das taxas das internações por condições sensíveis a atenção primária (ICSAP) em Sergipe e em suas sete regiões de saúde entre os anos de 2010 e 2019, correlacionando com os investimentos financeiros em saúde e na atenção primária, cobertura da estratégia de saúde da família e número de leitos.

Métodos: Trata-se de um estudo ecológico de tendências de séries temporais com dados secundários do Ministério da Saúde. A verificação da tendência foi realizada por análise linear segmentada e a correlação entre as variáveis foi feita pela correlação de Spearman.

Resultados: As ICSAP no estado de Sergipe apresentaram tendência de estabilidade. Na região de Nossa Senhora do Socorro foi identificado tendência crescente das taxas de 2010 a 2017 e tendência decrescente não significativa de 2017 a 2019, com correlação negativa com o investimento *per capita* em APS. A região de Itabaiana apresentou tendência de redução das taxas de 2010 a 2012, seguido de tendência de crescimento das taxas de 2012 a 2020, sem correlação significativa com nenhuma das variáveis.

Conclusões: Realizar o monitoramento das taxas de ICSAP e entender sua influência multifatorial são importantes, uma vez que esse indicador é útil no diagnóstico situacional local e contribuir para planejar ações.

INTRODUCTION

The creation of the Unified Health System - SUS (Sistema Único de Saúde) in Brazil has enabled progress toward universal health access¹. Primary Health Care (PHC) is the main entrance door to SUS. Other means of first access to SUS are Ambulatory Medical Assistance (AMAs), psychosocial care, and urgency and emergency services.

Effective primary care can meet about 85% of the population's health needs², preventing progression to more severe conditions that require hospitalization. One way to assess the quality of PHC is by using the indicator Hospitalizations for Ambulatory Care-Sensitive Conditions (HACSC), developed by Billings et al. in the 1990s and consolidated in the literature³⁻⁵. Ordinance No. 221 was published by the Ministry of Health on April 17, 2008, to standardize the ambulatory care-sensitive conditions in Brazil. The list is the result of a work validated by several specialists in public health in Brazil^{6,7}.

The decrease in HACSC rates leads to improvements in PHC and strengthening the Family Health Strategy (FHS) as a public health policy^{8,9}. High hospitalization rates do not always indicate deficiencies in primary care but should signal further investigation of where they occur⁶. Several factors influence this indicator, such as the characteristics of the patients, the variability of the criteria adopted to indicate hospitalization, and the admission policies of tertiary care centers¹⁰. This scenario is supported by Roemer's Law, which states that in the presence of hospital beds, these tend to be used regardless of the population's needs¹¹.

Health financing in Brazil has been insufficient and unevenly distributed, contributing to inequities in access to healthcare and affecting public health quality¹²⁻¹⁴. Some studies have shown a direct relationship between the prevention and control of HACSC and the performance of primary care services and more significant investments¹⁵⁻¹⁷.

This study analyzed the trend in hospitalization rates for ambulatory care-sensitive conditions in the state of Sergipe and its seven health regions between

2010 and 2019, correlating this trend with financial investments in health and primary care, FHS coverage, and the number of beds in the state, during the same period.

METHODS

This is an ecological time-series study on HACSC in the state of Sergipe (northeastern Brazil), considering as a unit of analysis each of its seven health regions, from January 1, 2010, to December 31, 2019. These regions are references from the Sergipe State Department of Health, present in the state health plan, 2016-2019.

Information on hospitalizations was obtained from the Hospital Information System (SIH/SUS) database of the SUS Department of Informatics (DATASUS) (<http://www2.datasus.gov.br>) and tabulated with TabWin software. The year of hospitalization, informed on each hospital admission authorization form (AIH), was used to define the temporality of the event; non-residents of Sergipe were excluded from this analysis.

The gross rates of HACSC were calculated by the ratio between the number of HACSC and the reference population for the assessed period multiplied by 1,000. The population used in the calculation was estimated by the Ministry of Health. The rates were standardized by the direct method, considering the proportion of the world population estimated by the WHO from 2000 to 2025.

The data were grouped into health regions, and descriptive analysis was performed using Microsoft Excel 2019. To identify significant changes in the variables' trend over time and estimate the annual percentage variation, the segmented linear regression analysis was performed using the Joinpoint software, version 4.8.8. The level of significance adopted was 5%. The series trend was classified as stable ($p > 0.05$), decreasing ($p \leq 0.05$ and negative regression coefficient), or increasing ($p \geq 0.05$ and positive regression coefficient).

The financial data were obtained from transfer statements, available in the Information System on Public Budgets in Health (SIOPS)

(<https://antigo.saude.gov.br/repasses-financeiros/siops>), and the indicators were established based on the expense paid for each year of the direct administration sub-function in health. The per capita health and PHC investments were calculated from the demographic data estimated by the Ministry of Health. All amounts were adjusted according to the Broad Consumer Price Index (IPCA) until 2019.

The annual percentage of the population covered by the FHS was obtained from information provided by the Department of Primary Health Care of the Ministry of Health (<https://egestorab.saude.gov.br/index.xhtml>), and the number of hospital beds was based on the National Registry of Health Establishments in the DATASUS (<http://www2.datasus.gov.br>). The number of beds per 1,000 inhabitants was calculated from the population data already obtained. The trend of per capita health investment, per capita PHC investment, FHS coverage, and the number of beds per 1,000 inhabitants was verified using the Joinpoint software (version 4.8.8). The Spearman correlation analysis was performed using the BioEstat software (version 5.3, Mamirauá Sustainable Development Institute, Belém, Pará, Brazil) to test the correlation of the abovementioned variables with the HACSC rates. Correlations with $p \leq 0.05$ and a moderate ($0.4 \leq r \leq 0.7$) or strong ($0.7 < r < 1.0$) level were considered statistically significant¹⁸.

RESULTS

From 2010 to 2019, 926,564 people were hospitalized in Sergipe, whose population increased from 2,108,297 to 2,298,696 in the same period. There were 129,836 HACSC, which represented 14.01% of the total number of hospitalizations in this decade.

Propriá and Aracaju were the health regions with the highest hospitalization rates. The HACSC remained stable in the state and five of the seven health regions (Table 1).

In Nossa Senhora do Socorro, there was an increasing trend from 2010 to 2017 and non-significant decreasing trend from 2017 to 2019. The region of Itabaiana showed a decreasing trend from 2010 to 2012, followed by an increasing trend from 2012 to 2020 (Table 1).

Investment in health in Sergipe ranged from R\$ 1,112,646,230.75 in 2010 to R\$ 1,364,379,362.26 in 2019. Per capita health investments had a median of R\$ 613.16, with a trend toward stability in the decade and per capita investment in primary care showed a decreasing trend in this period, with a median of R\$ 184.16. All values were adjusted according to the IPCA until 2019 (Table 2).

There was a trend for an increase in per capita health investment in the regions of Propriá, Nossa Senhora do Socorro, and Estância. The regions of Aracaju, Nossa Senhora do Socorro, Estância, and Itabaiana had a decrease in per capita HPC investment, in the decade (Table 2).

In 2019, PHC in Sergipe accounted for 25.21% of the financial health resources. The highest investment was recorded for Propriá (43.14%) and the lowest one for

Aracaju (12.21%) (Table 3).

The FHS coverage in Sergipe varied from 86.26% in 2010 to 82.53% in 2019, with a median value of 84.97% during this period. In these ten years, there was a decrease in FHS coverage in the region of Aracaju, and an increase in Estância, Itabaiana, and Lagarto, whereas in the other regions, the FHS coverage remained stable. The number of beds per 1,000 inhabitants decreased in the state and the health regions. Aracaju had the highest rate, 1.91 beds per 1,000

The Spearman correlation showed a moderate negative correlation in the per capita PHC investment in Nossa Senhora do Socorro, i.e., as this type of investment decreased, the HACSC rates increased, with statistical significance in that region. The number of hospital beds correlated negatively with the HACSC rates in Nossa Senhora do Socorro and Estância, and positively in Nossa Senhora da Glória (Table 5).

DISCUSSION

Among the hospitalizations recorded from 2010 to 2019 in Sergipe, 14.01% were due to ACSC. The HACSC rates were stable in Sergipe in the analyzed years. Similar studies found a decrease in the trend of these rates in Goiás from 2005 to 2015¹⁹, Florianópolis (2001-2011)⁹, Ceará (2000-2012)²⁰, Pernambuco (2008-2012)²¹, and Espírito Santo (2000-2014)²², and a trend toward stability in Rondônia (2012-2016) and Porto Alegre (1998-2012)²⁴. The value found for Sergipe was lower than those recorded in several other studies focusing on other states: 30.0% of HACSC in Goiás¹⁹, 24.8% in Rondônia²³, 20.0% in the Federal District (Brasília), and 15.9% in São Paulo⁴.

The HACSC rate indicated stability in most health regions, two of which had different characteristics: Nossa Senhora do Socorro, which showed an increasing trend in rates until 2017 and a subsequent non-significant decreasing trend, and Itabaiana, which showed a decreasing trend in rates from 2010 to 2012, followed by an increasing trend from 2012 to 2019. The behavior of the rate trends was analyzed based on the inclusion of all HACSC. There was no stratification by age, gender, or cause of hospitalization.

Per capita health investment remained stable in the state of Sergipe. In the analyzed decade, there was an increase in health investments in Nossa Senhora do Socorro, Estância, and Propriá. A study showed that Brazil's per capita expenditure on health was US\$ 1,056.00 in 2012, of which 46.9% was spent on public health, corresponding to US\$ 490.00 per capita²⁵. In the same year, Sergipe had a per capita expenditure of approximately US\$ 230.47, less than the per capita amount spent in Brazil, considered insufficient in several studies^{12,13}. The investment in Aracaju was the closest to the country's average in 2012, accounting for US\$ 317.09.

Over the years, there was a decrease in per capita PHC investment in Sergipe. In 2019, according to the SIOPS, Brazil allocated 19.7% of total health expenditures to PHC, whereas Sergipe allocated 25.10%. Although the state investment is higher than the national average, decreasing trend is evident. As PHC is the main

Table 1 – Distribution of medians and trend of standardized rates of hospitalizations for ambulatory care sensitive conditions (HACSC) per 1,000 inhabitants, in Sergipe and in its health regions, from 2010 to 2019.

Location	HACSC rate	IQR	Period	Trend 1					Trend 2					Total Period		
				b	r ²	APC (%)	CI 95%%	P-value	Period	b	r ²	APC (%)	CI 95%%	P-value	AAPC (%)	CI 95%%
State of Sergipe	6.11	5.96 – 6.64	2010 to 2019	0.059	0.131	0.9	-1.0 – 2.9	0.323	-	-	-	-	-	-	0.9	-1.0 – 2.9
Health Region																
Aracaju	8.98	8.00 – 9.48	2010 to 2019	-0.072	0.030	-0.7	-4.4 – 3.2	0.647	-	-	-	-	-	-	-0.7	-4.4 – 3.2
N. Sra. do Socorro	5.03	3.86 – 5.46	2010 to 2019	0.473	0.956	12.7*	9.5 – 16.1	<0.001	2017 to 2019	-0.729	0.742	-13.1	-29.8 – 7.1	0.132	6.3*	2.2 – 10.7
Estância	4.52	4.09 – 4.82	2010 to 2019	0.110	0.285	2.6	-0.8 – 6.2	0.124	-	-	-	-	-	2.6	-0.8 – 6.2	
Itabaiana	2.43	1.92 – 2.88	2010 to 2019	-1.020	0.994	-34.4*	-55.7 – -2.9	0.037	2012 to 2019	0.244	0.891	11.8*	6.2 – 17.6	0.003	-0.7	-7.7 – 6.8
Lagarto	5.69	4.99 – 6.04	2010 to 2019	-0.076	0.110	-1.3	-4.4 – 1.9	0.421	-	-	-	-	-	-1.3	-4.4 – 1.9	
N. Sra. da Glória	2.22	1.94 – 2.74	2010 to 2019	-0.100	0.300	-4.4	-9.5 – 0.9	0.446	-	-	-	-	-	-4.4	-9.5 – 0.9	
Propriá	9.17	8.58 – 10.1	2010 to 2019	-0.275	0.299	-3.0	-7.0 – 1.1	0.129	-	-	-	-	-	-3.0	-7.0 – 1.1	

IQR: Interquartile range; APC: annual percent change; AAPC: average annual percent change; CI: confidence interval; *statistically significant results; b: regression coefficient and r²: Determination coefficient

Table 2 – Distribution of medians and trends in per capita PHC and health investments. corrected by the IPCA 12/2019, in Sergipe and in its health regions, from 2010 to 2019.

	Per capita PHC investment								Per capita health investment (IH)						
	Median	IQR	b	r ²	APC (%)	CI 95%	p-value	Median	IQR	b	r ²	APC (%)	CI 95%	p-value	
State of Sergipe	184.16	158.96 – 210.82	-8.109	0.726	-4.3*	-6.4 – -2.1	0.002	613.16	599.40 – 646.02	1.474	0.011	0.5	-1.3 – 2.3	0.724	
Health Region															
Aracaju	109.61	88.55 – 145.58	-9.724	0.889	-8.1*	-10.2 – -5.9	< 0.001	811.4	729.79 – 909.83	-12.022	0.131	-1.2	-3.6 – 1.2	0.289	
N. Sra. do Socorro	223.32	173.64 – 249.18	-10.05	0.558	-4.6*	-7.9 – -1.1	0.016	512.83	482.66 – 544.95	10.498	0.537	2.1*	0.5 – 3.7	0.015	
Estância	222.28	196.04 – 259.09	-9.316	0.540	-4.0*	-6.9 – -1.0	0.015	500.54	475.39 – 520.59	11.202	0.708	2.7*	0.5 – 4.9	0.002	
Itabaiana	250.78	160.89 – 196.23	-3.195	0.153	-4.4*	-8.2 – -0.4	0.034	511.89	493.10 – 544.85	5.363	0.219	1.1	-0.5 – 2.7	0.158	
Lagarto	174.36	196.51 – 271.62	-10.855	0.443	-1.8	-5.2 – 1.8	0.271	431.3	410.26 – 448.21	5.050	0.368	1.1	-0.4 – 2.6	0.056	
N. Sra da Glória	232.90	204.90 – 272.72	-5.219	0.157	-2.4	-6.4 – 1.9	0.228	535.73	509.09 – 556.96	2.930	0.089	0.6	0.9 – 2.0	0.400	
Propriá	270.61	245.64 – 283.82	2.510	0.100	0.9	-1.4 – 3.3	0.385	626.30	522.60 – 646.47	19.649	0.794	3.5*	2.0 – 4.9	0.001	

IQR: Interquartile range; APC: annual percent change; AAPC: average annual percent change; CI: confidence interval; *statistically significant results; b: regression coefficient and r²: Determination coefficient

Table 3 – Per capita investment in PHC, per capita investment in health and percentage of investment in PHC in relation to investment in health in Sergipe and its health regions in 2019.

Location	Per capita PHC investment (IPHC)	Per capita health investment (IH)	IPHC/IH percentage
State of Sergipe	R\$ 149.64	R\$ 593.54	25.21%
Health Region			
Aracaju	R\$ 83.08	R\$ 680.48	12.21%
N. Sra. do Socorro	R\$ 171.10	R\$ 575.47	29.73%
Estância	R\$ 193.87	R\$ 537.50	36.07%
Itabaiana	R\$ 178.53	R\$ 526.77	33.89%
Lagarto	R\$ 149.57	R\$ 420.83	35.54%
N. Sra. da Glória	R\$ 202.97	R\$ 559.17	36.30%
Propriá	R\$ 289.2	R\$ 670.36	43.14%

Table 4 – Distribution of medians, trends in FHS coverage, and the number of hospital beds per 1,000 inhabitants in Sergipe and in its health regions, from 2010 to 2019.

Location	Percentage of FHS coverage							No. of hospital beds per 1000 inhabitants						
	Median (%)	IQR	b	r ²	APC (%)	CI 95%	p-value	Median (%)	IQR	b	r ²	APC (%)	CI 95%	p-value
State of Sergipe	85.0	83.6 - 86.0	-0.309	0.297	-0.4	-0.8 - 0.1	0.100	1.14	1.05 - 1.37	-0.056	0.885	-4.5*	-5.7 - -3.4	<0.001
Health Region														
Aracaju	80.8	70.7 - 84.5	-2.452	0.896	-3.1*	-4.0 - -2.2	<0.001	1.91	1.77 - 2.20	-0.076	0.814	-3.8*	-5.1 - -2.4	<0.001
N. Sra. do Socorro	99.0	98.8 - 99.1	-0.089	0.865	-0.1	-0.2 - 0.1	0.020	0.79	0.78 - 1.30	-0.111	0.679	-9.5*	-15.2 - -3.5	0.003
Estância	93.6	87.8 - 84.4	1.075	0.660	1.2*	0.5 - 1.9	0.005	0.93	0.88 - 1.08	-0.055	0.670	-5.5*	-8.1 - -2.9	0.001
Itabaiana	85.8	85.4 - 85.9	0.209	0.862	0.2*	0.2 - 0.3	<0.001	0.48	0.47 - 0.62	-0.034	0.579	-6.4*	-8.3 - -4.4	0.012
Lagarto	74.5	58.5 - 77.9	3.030	0.831	4.6*	2.8 - 6.4	<0.001	0.88	0.71 - 0.95	-0.042	0.584	-5.1*	-7.9 - -2.3	0.008
N. Sra. da Glória	93.3	89.5 - 95.3	-0.027	0.042	1.0	-0.3 - 2.3	0.127	0.34	0.33 - 0.35	-0.010	0.651	-3.3*	-3.4 - -3.1	0.004
Propriá	98.9	97.8 - 99.4	0.076	0.015	0.1	-0.4 - 0.6	0.719	0.87	0.80 - 1.10	-0.069	0.626	-7.2*	-8.8 - -5.6	0.008

IQR: Interquartile range; APC: annual percent change; AAPC: average annual percent change; CI: confidence interval; *statistically significant results; b: regression coefficient and r²: Determination coefficient

Table 5 – Spearman correlation for the standardized HACSC rates in relation to per capita PHC and health investments, FHS coverage, and the number of hospital beds, in Sergipe and in its health regions, from 2010 to 2019.

Location	Per capita PHC investments		Per capita health investments		FHS coverage		No. of hospital beds	
	r	p	r	p	r	p	r	p
State of Sergipe	-0.152	0.338	-0.418	0.115	-0.467	0.087	-0.515	0.064
Health Region								
Aracaju	0.127	0.363	-0.515	0.064	0.091	0.401	-0.006	0.493
N. Sra. do Socorro	-0.564*	0.045	0.442	0.100	-0.152	0.338	-0.842*	0.001
Estância	-0.467	0.087	0.0552	0.051	0.527	0.059	-0.564*	0.045
Itabaiana	0.358	0.155	-0.042	0.454	0.345	0.164	0.382	0.138
Lagarto	0.322	0.182	0.377	0.142	-0.377	0.142	0.225	0.266
N. Sra. da Glória	0.103	0.388	-0.333	0.173	-0.515	0.064	0.588*	0.037
Propriá	-0.052*	0.049	-0.467	0.087	-0.176	0.314	0.164	0.326

r, regression coefficient; * statistically significant results.

entrance door to the health system and is responsible for about 80% of the demands, more significant investment in this sector was expected. In addition to decreasing trends, the region of Aracaju has the worst percentage of PHC investments (12.20%) compared to the total health expenditures in 2019. This scenario requires future analysis despite not reflecting the hospitalization rates found in this study.

FHS coverage remained constant in Sergipe, with a decreasing trend in Aracaju and increasing trend in Estância, Itabaiana, and Lagarto. Regardless of the trend, the median of FHS coverage was high in all regions, among which Lagarto had the lowest value (74.52%). The population covered by the FHS is distributed differently among the regions, urban centers, and small- and medium-sized cities^{26,27}. According to the Department of Primary Health Care of the Ministry of Health, the FHS coverage was 63.62% in Brazil in 2019. The northeastern region had the highest coverage (82.33%), whereas the southeastern region had the lowest one (50.99%). Some studies have shown a decrease in HACSC related to the expansion of FHS²⁸⁻³¹. In the decade analyzed in this research, only Lagarto had significant values of coverage expansion, whereas Aracaju had a significant decrease; however, these regions had no changes in hospitalization rates, leading us to believe that the previous high coverage was more important than the trend, regarding the number of hospitalizations in these regions.

The values found for the number of hospital beds per 1,000 inhabitants in Sergipe and its health regions are important, as they had a decreasing trend. National and international studies have shown a positive correlation between the number of beds and hospitalizations, following Roemer's Law^{32,33}. It was observed that, contrary to expectations, hospitalization trends in the state and the health regions did not follow the decrease in the number of beds. There was a positive correlation only in Nossa Senhora da Glória, with no impact on the hospitalization trend. These results evidence the importance of understanding the various factors contributing to these hospitalization rates. Information about the number of beds is often unreliable since it varies according to the needs and arrangements of the hospital³⁴.

The existence of two regions (Nossa Senhora do

Socorro and Itabaiana) with behavior different from the others is relevant. In Nossa Senhora do Socorro, there was a negative correlation between HACSC rates and per capita PHC investment. Therefore, the decrease in PHC investments is correlated with the increase in hospitalization rates. The data found in this region were against Roemer's Law since they indicated a negative correlation between hospitalization rates and the number of hospital beds. In the region of Itabaiana, there was no significant correlation between the analyzed variables. The HACSC rates have a multifactorial influence and this region had peculiarities not addressed in this study. Understanding the peculiarities of these regions is essential and should be the target of future studies. Some variables, such as socioeconomic and demographic characteristics and access to services, although not assessed here, are also contributing factors to changes in these hospitalizations⁹.

Ecological studies have their limitations, and the aspects verified in the community may not reflect the individual condition of the citizens of Sergipe. The HACSC rates recorded here were related to the state's total population and not to specific population groups. The unit of analysis consisted of hospitalization for ambulatory care-sensitive conditions; it is impossible to infer among the less hospitalized individuals who benefited from health investments and who used the FHS services⁹.

The problems arising from using secondary data are another limitation of this study. The SIH/SUS only contemplates hospitalizations in the public health system and does not allow us to identify readmissions, in addition to possibly underestimating some diagnoses whose reimbursements are lower³⁵. Another study identified a greater likelihood of an adequate record of diagnoses unrelated to HACSC³⁶. Despite this, the SIH/SUS is widely used in studies, and its results have been adequate for practical experience³⁷.

CONCLUSION

The continued use of HACSC rates for PHC monitoring is relevant. The understanding of the current pattern serves as a basis for future comparisons.

Expanding the understanding of other factors that may be related to this indicator is crucial.

The HACSC rate trends can be used as a source of data for decision-making by managers and professionals,

aiming at improving the health system and financial investments. Further studies should assess the impact of this indicator, given its usefulness in the local situational diagnosis and the capacity to guide actions.

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