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Trend in hospitalizations for conditions sensitive to primary care in Pelotas, Brazil, from 2000 to 2021

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Abstract *This article aims to describe the characteristics of hospitalizations for ambulatory care sensitive conditions (HACSC) in the municipality of Pelotas regarding occurrence by sex, age group and main causes in the period from 2000 to 2021. Additionally, a trend analysis of the HACSC in the municipality was carried out, comparing it with the rest of Rio Grande do Sul, its association with public expenditure per capita on health and with the population coverage of FHS. Ecological study using the ambulatory care sensitive conditions list from the Ministry of Health available in the Hospital Information System of the Unified Health System. Information on health expenditure was obtained from the Public Health Budget Information System. FHS coverage was available at the Primary Care Department. A decrease in HACSC was found in Pelotas and in the rest of the state. HACSC were more frequent in people aged 60 years or older. The main cause of hospitalization was heart failure. In Pelotas, FHS coverage and health expenditure were associated with HACSC. Despite the measures applied from 2017, policies implemented previously, the increase in health spending and the expansion of coverage may have influenced the decrease in HACSC.*
Key words *Hospitalization, Primary health care, Public expenditures on health, State health care coverage, Health care quality indicators*

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Introduction

The 2017 National Primary Care Policy, although it led to setbacks in organization and funding[1-3], maintained the effort to encourage strategies to institutionalize evaluation[4]. The monitoring of hospitalizations for sensitive conditions to ambulatory health care has proven to be an internationally recognized indicator, available and easy to operationalize, allowing for the evaluation of health systems[5,6].

In Brazil, following the publication of the Brazilian List of Primary Care Sensitive Conditions, various studies have monitored the behaviour of these hospitalizations in a variety of areas[7-10]. In the municipality of Pelotas/RS, HACSC have been studied since 1995, even before the launch of the Brazilian List, exploring trends, characteristics and costs, with the latest analysis corresponding to 2012[11,12]. Since then, several changes have been made to the local system, such as the expansion of the Family Health Strategy (FHS), the creation of an Emergency Care Unit and the incorporation of teleconsulting for primary care, against a backdrop of shrinking financial resources and the COVID-19 pandemic, prompting a new analysis of this indicator.

HACSC have varied according to certain characteristics of the municipalities, such as FHS coverage and economic conditions[13,14]. As the gateway to the Unified Health System, the FHS has influenced health indicators, including HACSC.[15,16].

Throughout its history, health financing in Brazil has been admittedly insufficient to provide the necessary quality at all levels of care[17,18]. In the current context, with the financial difficulties imposed by government budget restrictions[19] and the impact of the COVID-19 pandemic[20] in the economy, the aim was to verify how public expenditure per capita on health impacted the behavior of HACSC in Pelotas.

The aim of the study was to describe the characteristics of HACSC in the municipality of Pelotas in terms of occurrence by sex, age group and main causes between 2000 and 2021. In addition, a trend analysis of HACSC in the municipality was carried out, comparing it with the rest of Rio Grande do Sul, its association with public expenditure per capita on health and with FHS population coverage.

Methods

This is an ecological study comparing the trend of HACSC in the municipality of Pelotas with the rest of the state of Rio Grande do Sul between 2000 and 2021.

Pelotas is a municipality located in the southern region of Rio Grande do Sul State, with an area of 1609 km^2 and an estimated population of 324,026 inhabitants in 2022, making it the fourth most populous city in the state. In 2020, the Municipal Human Development Index reached 0.739, the GDP per capita was R$ 27,671.06, placing the municipality in 356th place in Rio Grande do Sul. Pelotas is home to three universities, all of which work in the health sector, with two medical schools, four general hospitals linked to the SUS, a psychiatric hospital, a UPA and 51 primary care centers distributed in urban and rural areas.

The analysis included ambulatory care-sensitive conditions listed by the Ministry of Health, available on DATASUS, captured by TABWIN in the Hospital Information System of the Unified Health System (SIH/SUS).

The data on the resident population in Pelotas used to calculate the coefficients was available on DATASUS and was collected via TABNET, in the demographic and socioeconomic information section, with estimates by sex and age from 2000 to 2021.

Information was collected on hospitalizations for other causes in Pelotas, excluding obstetrics. Hospitalizations due to other causes were included in the analysis, because factors such as the number of beds available, changes in the SUS table and seasonal variations could interfere with or even influence the behavior of HACSC.

The crude coefficients were calculated from the ratio between the number of HACSC and the resident population according to age group, sex and year per 1000 inhabitants. It is known that the occurrence of HACSC has varied according to gender[9] and age group[21] to control for differences in demographic structure in trend analyses, the coefficients were standardized directly using the population of Rio Grande do Sul in 2010.

The analysis of the HACSC coefficients by age group was presented in a figure with moving averages every seven years (2000-2007, 2008-2014 and 2015-2021) taking as categories: up to nine years old, 10 to 19 years old, 20 to 39 years old, 40 to 59 years old and 60 years old or more.

The five main causes of HACSC in the period were listed, showing their percentage in relation to the total.

FHS population coverage was available on the website of the Ministry of Health's Primary Care Department and was collected as a percentage using the month of December of each year as a reference, except for 2021, which is still unavailable.

Public expenditure per capita on health in Pelotas and the rest of Rio Grande do Sul was collected from information available in the Public Health Budget Information System (SIOPS), obtained by administrative expenditure by direct subfunction. Public expenditure per capita on health was calculated using the formula: (total expenditure settled per year/resident population in each year). In order to reduce price variations due to inflation, the deflator resource was applied. In this way, the amounts were adjusted according to the National Broad Consumer Price Index of the Brazilian Institute of Geography and Statistics using the Citizen's Calculator available on the Central Bank of Brazil's website. The last day of December 2021 was used as the reference for the adjustment.

The trend analysis of the HACSC coefficients for both Pelotas and the rest of Rio Grande do Sul used the generalized Prais-Winsten regression. This method corrects the First Order Serial Auto Correlation (AR-1) error common in time series, overestimating the results analyzed. The results were interpreted as follows: decreasing trend (p-value < 0.05 and negative coefficient), increasing trend (p-value < 0.05 and positive coefficient) and stable trend (p-value > 0.05)[22].

The same method was used to analyze the association between the HACSC coefficients, public expenditure per capita on health and FHS population coverage, with a p-value < 0.05 being interpreted as a statistically significant result. It should be noted that the association between HACSC and FHS in Pelotas considered the period between 2002 and 2020.

This study was carried out using secondary data available in public information systems, which did not allow for the identification of individuals, exempting it from the obligation of approval by the Research Ethics Committee in accordance with Resolution 466/2012 of the National Health Council.

Results

Between 2000 and 2021, a total of 22 years, there were 71,973 HACSC in the municipality of Pelotas, with hospitalization coefficients ranging from 21.2 per thousand inhabitants in 2000 to 3.6 per thousand inhabitants in 2021, showing a downward trend. The downward trend in HACSC coefficients revealed in Pelotas was also seen in the rest of Rio Grande do Sul, despite the sudden increase in 2020. Analysis over the period showed that the HACSC coefficients observed in Pelotas were lower than those in the rest of Rio Grande do Sul. In the years of the pandemic, Pelotas had the lowest coefficients of the entire period, while in the rest of Rio Grande do Sul in 2020 there was a sudden increase in the occurrence of HACSC, back to the levels found in 2007 and 2008, decreasing again the following year to reach the lowest value. Hospitalizations due to other causes in Pelotas also decreased, while in 2000 the coefficient reached 47.0 per thousand inhabitants, last year it was 33.9 (Table 1). The analysis of HACSC in Pelotas found no differences between the sexes, but in the rest of Rio Grande do Sul there was a predominance of hospitalizations among women (Table 1).

The trend analysis confirmed the decrease in HACSC in Pelotas (-0.65; 95%CI -0.86 to -0.44; p-value < 0.001) and in the rest of Rio Grande do Sul (-0.71; 95%CI -0.91 to -0.51; p-value < 0.001), despite the peak increase in 2020, but showed stability in the coefficients of hospitalizations for other causes (-0.15; 95%CI -0.57 to 0.26; p-value = 0.440).

A comparison of the decreasing trends in HACSC coefficients showed a lower occurrence in Pelotas compared to the rest of the state (Figure 1). In turn, in the municipality of Pelotas, the comparison between the trend curves for HACSC and the other causes of hospitalizations showed different shapes (Figure 2).

In Pelotas, the highest HACSC coefficients were found among individuals aged 60 and over, followed by the group aged up to nine, while the lowest values were found in the 10-19 age group. Observing the moving averages showed that each period did not overlap with the previous one, again showing a drop in HACSC, with the coefficients of the age groups decreasing over the periods analyzed (Figure 3).

The main causes of hospitalizations for ambulatory care-sensitive conditions in the period analyzed were: heart failure (13.2%), angina (10.7%), cerebrovascular diseases (9.8%), kidney

Table 1. Coefficients of Hospitalizations for ambulatory care sensitive conditions and for other causes in the municipality of Pelotas and in Rio Grande do Sul by sex from 2000 to 2021.

	HACSC						Other causes		
	Pelotas*			RS*			Pelotas*		
	Male	Fem	Total	Male	Fem	Total	Male	Fem	Total
2000	20.8	21.9	21.2	25.9	27.6	26.7	50.9	43.5	47.0
2001	16.7	17.6	17.1	24.4	25.6	25.0	47.5	40.4	43.8
2002	14.9	14.5	14.6	23.1	23.9	23.5	43.9	40.1	41.9
2003	11.2	10.5	10.8	23.1	23.2	23.1	34.8	30.9	32.7
2004	11.4	11.8	11.6	20.5	20.7	20.6	38.5	38.8	38.6
2005	8.4	10.2	9.3	20.5	20.7	20.6	39.3	39.9	39.6
2006	9.9	10.2	10.0	12.7	14.1	13.5	39.1	39.6	39.4
2007	11.5	12.0	11.7	19.1	19.7	19.4	40.9	38.9	39.8
2008	11.2	11.0	11.0	18.4	18.7	18.6	39.8	40.2	40.0
2009	11.5	10.8	11.1	15.8	16.4	16.1	39.3	37.3	38.3
2010	10.2	9.3	9.7	15.5	16.0	15.8	38.8	38.5	38.7
2011	10.1	9.7	9.8	13.6	13.9	13.8	38.8	39.2	39.0
2012	7.3	7.8	7.5	13.3	13.9	13.6	38.5	39.0	38.7
2013	7.5	7.2	7.3	12.8	13.5	13.2	42.0	40.4	41.1
2014	7.2	8.0	7.6	11.5	11.4	11.5	45.9	41.5	43.6
2015	8.4	7.6	8.0	12.2	12.8	12.5	48.4	44.8	46.5
2016	7.2	7.0	7.1	11.6	11.9	11.7	47.2	44.3	45.6
2017	6.3	6.1	6.2	11.0	11.4	11.2	44.3	40.7	42.4
2018	5.7	5.6	5.6	10.3	10.7	10.5	43.8	40.2	41.9
2019	5.5	5.4	5.4	10.4	10.5	10.5	40.4	37.9	39.1
2020	4.3	4.4	4.3	18.4	19.4	18.8	34.4	31.7	33.0
2021	3.6	3.7	3.6	7.3	7.3	7.3	39.4	36.5	37.9

*Coefficient per thousand inhabitants.

Source: Authors.

and urinary tract infections (9.7%) and lung diseases (9.3%).

FHS coverage in Pelotas showed progressive growth until 2017 when it reached 75.5%. In Rio Grande do Sul, there were three periods. The first was until 2007, with a progressive increase in coverage until it reached 75.5%, followed by a drop to 34.2% the following year and gradual growth until 2018 (Table 2). The trend analysis of FHS coverage in Pelotas (2.84; 95%CI 1.19 to 4.49; p-value = 0.002) showed an increase in coverage between 2002 and 2020. FHS coverage in the rest of Rio Grande do Sul was stationary (0.83; 95%CI -1.03 to 2.70; p-value = 0.363).

As for public expenditure per capita on health, there was a clear increase both in Pelotas and in the rest of Rio Grande do Sul over the period, and it was three times higher than the initial figure in both places. In the comparison, spending in Pelotas was higher until 2005, after which there were higher figures in the rest of Rio Grande do Sul (Table 2). The trend analysis confirmed the growth in public expenditure per capita on health both in Pelotas (29.89; 95%CI 23.60 to 36.18; p-value < 0.001) and in the rest of Rio Grande do Sul (37.43; 95%CI 31.71 to 43.15; p-value < 0.001).

In Pelotas, the analysis revealed an inversely proportional association between HACSC and FHS coverage (-0.11; 95%CI -0.15 to -0.07; p-value < 0.001) and with public expenditure per capita on health (-0.02; 95%CI -0.02 to -0.01; p-value < 0.001). In the rest of Rio Grande do Sul, the results of the association analysis showed that FHS coverage (-0.06; 95%CI -0.20 to 0.08; p-value = 0.406) was not associated with HACSC. However, a significant increase in public expenditure per capita on health (-0.02; 95%CI -0.02 to -0.01; p-value < 0.001) was associated with a decrease in HACSC.

Discussion

The results showed a decrease in HACSC over the period studied both in Pelotas, the subject

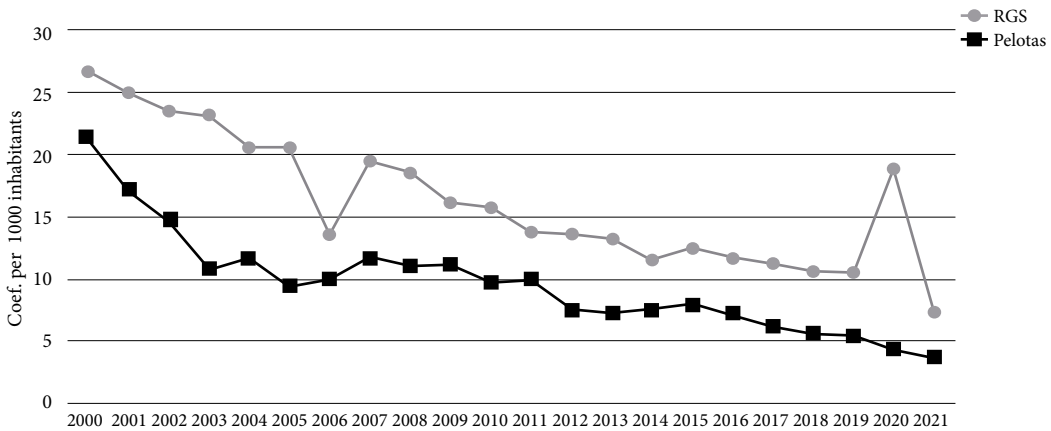

Figure 1. Trends in HACSC coefficients per 1000 inhabitants in Pelotas and Rio Grande do Sul from 2000 to 2021

Source: Authors.

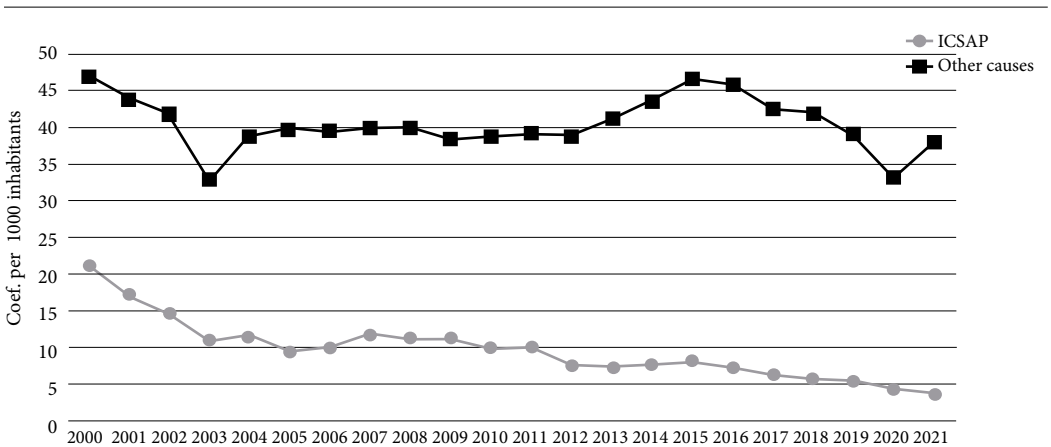

Figure 2. Trends in the coefficients of hospitalizations due to ACSC and other causes per 1000 inhabitants in Pelotas from 2000 to 2021.

Source: Authors.

of this study, and in the rest of the state of Rio Grande do Sul. This trend was more evident when viewing the curves from 2011 onwards and was confirmed by the regression analysis. Other ecological studies carried out recently in Brazil have used different time periods, trend analysis methods and population groups and have found a reduction in HACSC coefficients. A study analyzing Brazil and its regions using standardized rates according to simple linear regression and a gamma generalized linear model also showed a decrease in HACSC coefficients between 2010 and 2019[9]. Viacava et al. analyzed the period from 2000 to 2021 and found that HACSC decreased in Brazil and in the major regions by analyzing their percentage in relation to total hospitalizations[21]. In the state of Goiás, from 2010 to 2015, the Prais-Winsten generalized linear regression analysis found a downward trend in HACSC coefficients in most health regions[15]. In the state of Rondônia, between 2012 and 2016, there was a slight downward trend in the frequency of

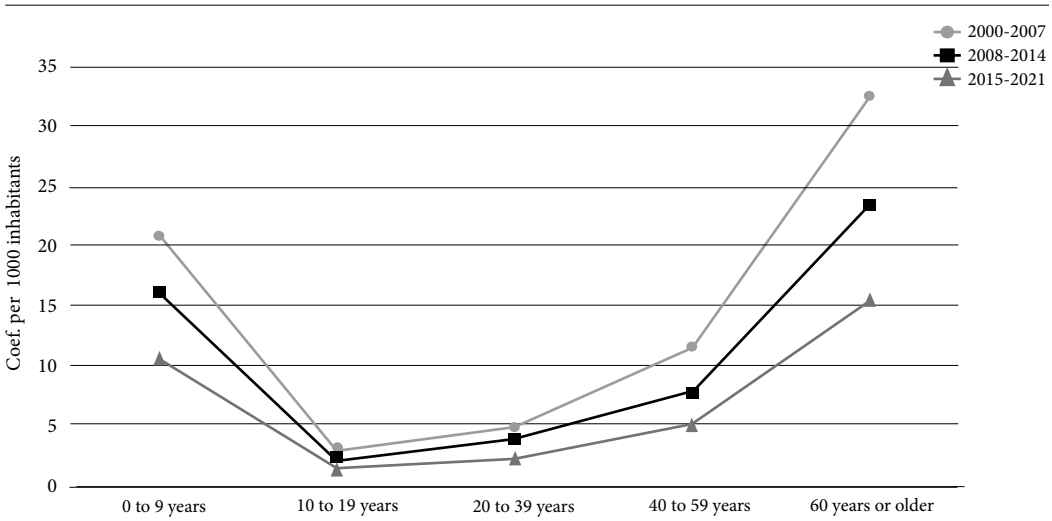

Figure 3. HACSC coefficients per 1000 inhabitants by age group and period in Pelotas/RS.

Source: Authors.

Table 2. Public expenditure per capita on health and FHS population coverage in Pelotas and Rio Grande do Sul, 2000 a 2021.

	Public expenditure per capita on health		FHS coverage (%)	
	Pelotas	**RS**	**Pelotas**	**RS**
2000	323.29	359.00	-	26.0
2001	543.53	391.91	-	39.4
2002	511.75	401.17	15.9	51.7
2003	475.61	394.01	22.1	57.6
2004	500.92	442.69	28.1	63.2
2005	516.83	470.99	30.2	67.8
2006	479.81	530.66	29.2	73.3
2007	526.31	550.81	24.9	75.5
2008	560.03	610.65	28.4	34.2
2009	615.43	646.24	25.1	35.2
2010	626.43	683.46	22.0	35.9
2011	688.74	735.10	25.2	37.2
2012	774.85	838.78	34.4	39.5
2013	829.15	900.10	44.6	41.9
2014	935.02	993.73	66.1	46.7
2015	861.34	917.99	66.3	53.8
2016	860.57	929.55	62.6	56.6
2017	907.94	950.21	75.5	56.6
2018	874.04	977.64	73.6	60.5
2019	858.26	985.21	64.2	59.6
2020	986.89	1.088.49	61.5	56.2
2021	1007.62	1.109.53	-	-

Source: Authors.

HACSC in relation to all hospitalizations[23]. A study carried out in Santa Catarina between 2008 and 2015 evaluated the coefficients of HACSC in older adults using an analysis stratified by sex, with standardized rates and segmented linear regression, showing a decrease in hospitalizations,

with the greatest variation being among women and in older adults over 80 years old, especially since 2012[7]. In Rio Grande do Norte, from 2008 to 2016, there was a reduction in HACSC in the population aged 60 and over, starting in 2011[24]. In Senador Canedo/GO, from 2001 to 2016, Prais-Winsten regression found a downward temporal trend in HACSC for cardiovascular diseases as a whole and in hospitalization rates for heart failure[8]. This set of positive results is probably associated with improvements in the quality of primary care. A study carried out with data from the National Program for Improving Primary Care Access and Quality (PMAQ-AB) showed that in the municipalities with the best evaluation, the number of HACSC was lower[14].

The decrease in HACSC coefficients observed in Pelotas during the pandemic may be following trends detected in other studies carried out in Brazil. An ecological study including the entire country and checking hospitalizations for all causes from 2017 to 2021 revealed a decrease in the number of hospitalizations for chronic non-communicable diseases, regardless of gender and age group, with the greatest decreases in the North and South regions, because of the scenario of social distancing and the overload of health services[25]. Albuquerque et al. showed a reduction in hospital admissions due to non-COVID respiratory diseases, showing falls in conditions such as asthma, pneumonia, acute bronchitis, chronic obstructive pulmonary disease and bronchiectasis, all included in the Brazilian List of Primary Care Sensitive Conditions[26].

The analysis of the occurrence of HACSC showed no predominance between the sexes in Pelotas, although in the rest of Rio Grande do Sul the coefficients were higher among women. Other studies conducted in Brazil have also shown the occurrence of HACSC according to sex in different directions. Viacava *et al*. showed slightly higher values in male residents[21]. While the study by Santos et al. showed higher standardized rates in males in almost the entire country, except for the Southeast region[9]. As expected, there was a higher occurrence of HACSC among people aged 60 or over, followed by those aged up to nine. Other studies have also shown higher hospitalization rates in the extreme age groups[9,14].

Among the main causes of hospitalization, there was a predominance of chronic non-communicable diseases in the period, following the trend of other studies carried out in Brazil. Viacava et al. analyzed HACSC in a period similar to the present study and showed that the most frequent causes in the South were: stroke, heart failure, urinary tract infection, unstable angina and bacterial pneumonia[21]. Santos *et al*. (2022) conducted an ecological study from 2010 to 2019, analyzing the main causes according to gender[9]. In 2019, the main reasons for hospitalization were kidney and urinary tract infections, infectious gastroenteritis and complications and cerebrovascular diseases among women. Among men, the highest causes of hospitalization were cerebrovascular diseases, infectious gastroenteritis and complications and heart failure, i.e. a ratio of conditions very similar to that in Pelotas, with a predominance of chronic non-communicable diseases. Certainly programs such as *HiperDia, Farmácia Popular* and Telehealth have contributed to the reduction in HACSC.

The results showed that an increase in FHS coverage and public expenditure per capita on health were associated with a reduction in HACSC in Pelotas, in line with the results of other studies[15,27]. Studies have classified the FHS as consolidated when it has 70% population coverage and has been in operation for four years[28]. In the present study, population coverage of the FHS in Pelotas and the rest of Rio Grande do Sul decreased from 2018 onwards, falling into the intermediate classification (coverage between 30 and 69%). This result may have been due to the end of the *Mais Médicos Program*[29] in 2019 and the implementation of the *Previne Brasil Program*[30], a new form of financing for primary care that instituted remuneration for attracting patients, among other measures.

Despite the significant increase in public expenditure per capita on health found in this study, it is worth noting that the highest figures reached in Pelotas and Rio Grande do Sul in 2021 were US$ 202.75 and US$ 223.26 respectively. For comparison, the emblematic article by Macincko and Harris[31] in 2015 had already shown that public expenditure per capita on health in Brazil amounted to US$ 1056.00, but 57.8% of this amount was private. More recently, after the introduction and definition of spending in the spheres of government and health financing, several authors have reflected that in Brazil the percentages of Gross Domestic Product invested in health are comparable with the countries of the Organization for Economic Cooperation and Development (OECD), however, the fact that more than 50% of the resources invested are private remains, signaling still insufficient public financing[32,33].

Ecological studies have their own limitations due to their design, such as the ecological fallacy

and the use of secondary data, which is prone to under-recording, representativeness, and classification problems. However, the SIH/SUS was created for accounting purposes, reducing the possibility of these errors. As for representativeness, the SIH/SUS is restricted to information on admissions from hospitals accredited to the SUS, but it is certainly the system used by most of the population of Pelotas. Another problem is the possibility of cases of readmission of the same individuals, undetectable in the data collection, but which in this analysis would overestimate the coefficients, reinforcing the results. As for the quality of the data, it is known that information systems have been increasingly used to improve their quality, and hospital admissions have been audited by the Municipal Health Department. It should be noted that the analysis was conducted using a robust and appropriate method, the time series was long and the standardization of the coefficients eliminated differences in structure by gender and age, allowing comparisons to be made.

The permanent monitoring of HACSC should be supported and practiced by municipalities because it is an available, quick and inexpensive indicator, providing data for understanding the local health system, and can help management in their relationship with the hospital sector, as well as qualifying primary care. Despite the evident decrease in HACSC shown in this study, there is still a need to analyze aspects that could be incorporated to encourage a reduction in this indicator, such as subsidizing continuing education and the adoption of clinical protocols based on the observation of hospitalizations by groups of the most prevalent causes.

Collaborations

DN Stahnke: collecting and analyzing data and writing the manuscript. Brunna Machado Medeiros: data analysis and manuscript writing. RB Martins: manuscript writing and final revision. JSD Costa: designing the study, collecting and analyzing the data and writing the manuscript.

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