

Public policies reflected on hospitalizations for ambulatory care sensitive conditions: an ecological study in Sergipe-Brazil, 2008-2017

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Abstract

Background: Hospitalization for Ambulatory Care Sensitive Conditions (HACSC) are an indicator of failure at this level of the health system. Since 2006, a series of actions have been taken in Brazil to promote Primary Health Care (PHC), a situation that has changed radically since 2014. To analyze the trend of the HACSC in Sergipe, in the period from 2008 to 2017.

Methods: Ecological time-trend analysis. The data were extracted from the hospital admission authorizations on Hospital Information System in Brazilian Unified Health System. It was classified according to the Brazilian List of HACSC. The rates were standardized by the indirect method.

Findings: There were 608,083 non-obstetric admissions and 125,497 HACSC (20.6%), with an overall rate of 5.8 admissions per thousand inhabitants (5.7 male and 5.8 female). The trend described a U-curve, decreasing from 2008 to 2011, with little oscillation from 2011 to 2014, rising from 2014 to 2017. The rate was considerably higher in men over the age of 70. Throughout the period, the most frequent causes were: gastroenteritis and complications (15.6%), kidney and urinary tract infection (9.4%), asthma (9.2%), heart failure (8.8%), cerebrovascular (8.1%), and diabetes mellitus (7.2%).

Conclusion: The indicator improved in the initial period of the study, following the introduction of public policies that strengthened PHC, and worsened as they were withdrawn or neglected.

Background

Primary Health Care (PHC) is a model for organizing citizens' first contact with health services, it was proposed in 1975 by the World Health Organization (WHO) as a Global Strategy for Health by Year 2000 (SPT-2000) and it strongly reiterated at the famous Alma-Ata Conference in 1978. PHC works with a generalist multi-professional team to offer integral and longitudinal care to all citizens of a defined territory, through individual and community actions. It is guided by principles of bond and co-responsibility between professionals and users, and the health team and the community, and should be resolute for the vast majority of health problems and coordinator of care in the different instances of health care¹. Substantial evidence has recognized PHC as the most effective, efficient, safe and equitable organizational model to the basis of health care².

The Brazilian Constitution of 1988, the result of the country's fight for re-democratization, it was included a chapter for social security, which enunciates health as a right and created the Unified Health System (Sistema Único de Saúde - SUS) of universal and equitable access for health promotion, protection, and recovery, despite the system's underfunding³. After implementing SUS, the changes path of the PHC in Brazil was paved by Community Health Workers Program (Programa de Agentes Comunitários de Saúde - PACS) and Family Health Program (Programa Saúde da Família - PSF), created at the end of 1993 as a strategy to change the Brazilian model of care. In 2006, when Brazil finally adopted a National Basic Care Policy (Política Nacional de Atenção Básica - PNAB), it became the primary organization for PHC, adopting the name of Family Health Strategy (Estratégia Saúde da Família - ESF)⁴. ESF is a national

strategy, with financial incentives (until 2017) for its adoption by the municipality, which is voluntary and does not require complete populational coverage. Therefore, we have different coverage in the country and within municipalities.

Health management should be guided by quality information available to the manager and social control. Among the instruments for evaluating the effectiveness of PHC is the Hospitalizations for Ambulatory Care Sensitive Conditions (HACSC) indicator. Ambulatory Care Sensitive Conditions (ACSC) are health problems typically seen at the first level of the health system and whose evolution will require hospitalization of the patient in the absence of effective and timely intervention. Examples are the prevention of the incidence of diseases, such as in the use of vaccines and syphilis treatment in pregnant women; the treatment of acute episodes, such as in the case of dehydration and bacterial pneumonia; and the control of prevalent chronic conditions such as diabetes mellitus and systemic arterial hypertension, thus avoiding or delaying hospitalizations for renal failure, peripheral arterial disease, diabetic foot, acute myocardial infarction or strokes^{5,6}.

The use of the indicator is based on the premise that hospitalization at the moment it occurs, is necessary for the patient. This need results from failures in the first level of the health system^{5,6}. In 2008, the Ministry of Health published the Brazilian List of Sensitive Conditions for Primary Health Care, instituted by the Ministry of Health's Ordinance No. 221 of April 17, 2008⁷. The list, composed of 19 groups of causes, and widely accepted by the academic community, facilitates the performance and provides greater consistency to indirect evaluation studies of the effectiveness of PHC in Brazil.

Brazilian studies have shown the expansion of the ESF, associated with a significant reduction in HACSC. From 1998 to 2006 there was a 17% reduction in the HACSC rate, while ESF teams throughout Brazil increased from 3062 in 1998 to 26,364 in 2006⁸. In Sergipe, the decrease of HACSC rates is in part due to the More Doctors Program (PMM), an emergency physician allocation program for PHC in hard-to-reach areas, supported in large part by the Cuban Government's collaboration by sending doctors⁹. The Brazilian Northeast, where this study is performed, has the lowest Human Development and life expectancy rates, the worst infrastructure indicators (basic sanitation such as sewage and piped water), poor schooling, and the highest child mortality rates, compared to other Brazilian regions¹⁰.

From 2006, a set of public policies were implemented to better organize the SUS, guided by a logic centered on universal, integral, longitudinal, and attention coordinative PHC. Since 2013, however, Brazil has been experiencing a political, legal, and economic instability scenario and it has discontinued social, cultural, and environmental policies, as measures to confront the economic crisis, the so-called "austericide"¹¹. In the political field after the impeachment of President Dilma Rousseff in 2016, we culminated with the unbelievable Bolsonaro government¹². In public health, we saw the reduction of vaccination coverage by half, the increase in infant and child mortality from 2016, and maternal mortality in 2018, as well as the measles epidemic in 2019¹³. Therefore, we should expect that the political and institutional weaknesses, the cut in resources, and the consequent weakening of SUS management that led to the worsening of the aforementioned indicators, will also compromise the effectiveness of PHC.

No studies were found that evaluate the effectiveness of PHC in this period in Sergipe with this focus. The objective of this study is to contribute filling this gap by analyzing the evolution of HACSC rates in Sergipe in the years 2008 to 2017, a period that encompasses investment in PHC, political instability, and finally the implementation of fiscal austerity policies.

Methods

The state of Sergipe, the smallest in territorial extension in Brazil, with 21,926,908 km², is part of the Brazilian semi-arid region, which has, among other characteristics, the daily percentage of water deficit equal to or greater than 60%. The Human Development Index was 0.665 in 2010. The population of Sergipe, in its 75 municipalities, in 2010 census had 2,068,017 inhabitants, of which 51.4% were women and 73.5% lived in an urban area, according to Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística – IBGE) in 2010. PACS and PSF in Sergipe were created in 1998 and ESF began in 2007, a year in which 127 family health teams were established, covering 87% of the population¹³, and remained at these proportions until the end of the study in 2017.

An ecological study was conducted using the Databases from the SUS Hospital Information System (BD-HIS/SUS). The so called “reduced files” of Hospitalization Admission Authorization (AIH) were used, from which the main diagnosis of the hospitalization, date of admission, gender, age, and city of residence were obtained. These “AIH files” are made available in separate files by State and month of admission billing (called “month of competence”), which is the same month of hospitalization in most cases. But the AIH can be billed later, which can cause both inclusion of cases occurring a few months before the period of interest and loss of cases in the last months of the selected period that were billed later. To avoid these problems, the data files of the State of Sergipe were read from January 2008 to July 2018, afterward, only those cases whose hospitalization occurred from 01/01/2008 to 31/12/2017 were selected. Only cases of citizens residing in Sergipe were also selected. Finally, hospitalizations for obstetric procedures to treat non-morbid conditions such as childbirth and abortion were excluded. Hospitalizations were classified as ACSC according to the Brazilian List of Ambulatory Care Sensitive Conditions, composed of a wide range of 19 groups of causes.

The crude rates of HACSC per year were calculated, then standardized by sex and age by the indirect method (calculation of the Standardized Hospitalization Ratio - SHR), taking 2014 as the reference year, since it is the lowest crude rate. Thus, the meaning of every presented SHR is how much the rate that year was higher than in 2014, adjusted for gender and age - leaving 1 to the value presented and multiplying by 100, obtaining the value in proportion, i.e., an SHR = 1.241 means a HACSC rate 24.1% higher than that observed in 2014, the lowest rate of the period.

The standardized rates trend in the period was analyzed by simple linear regression, despite a positive autocorrelation (Durbin-Watson test = 0.6; $p < 0.001$). Given the observed distribution, two explanatory models of the distribution of SHR as a function of time were tested: one considering the year plus a quadratic term of the year ($\text{SHR} = \text{intercept} + \text{year} + \text{year}^2$) and another dividing the period into three

(2008-2010, 2011-2014, 2015-2017), analyzed as a categorical variable. Considering the few observations and the percentile distribution of the residues, the models were considered adequate. Data capture on the internet, reading of files, classification of hospitalizations, analysis, and graphical presentation were performed using the R statistical software. For data capture and reading, the *microdatasus14* package was used and the classification was made by the *csapAIH15* package. Compressed files (DATASUS .dbc format) are read by the *read.dbc16* package. Since AIH files are publicly accessible without locks (with access restrictions from outside Brazil since 2017), the process we have performed can be reproduced in R by running the command *script* file, which may be requested from authors.

This research is part of the Ph.D. project: Hospitalizations due to Ambulatory Care Sensitive Conditions in Sergipe-Brazil follows the ethical recommendations of the National Health Council contained in Resolution No. 466 of December 12, 2012, submitted to the Committee of Ethics and Research of the Federal University of Sergipe and approved under Ruling No. 2.232.566 and CAAE: 69111717.5.0000.5546.

Results

During this period of ten years analyzed, there were 608,353 hospitalizations, excluding obstetric hospitalizations, well distributed between genders (49% males, 51% females). In the period, there were 125,497 cases of HACSC, representing a global rate of 5.8 HACSC per thousand inhabitants (Table 1). The rate distribution shows a curve in U, falling until 2011, stabilizing with some oscillation until 2014, when it reaches the lowest rate, and then rising consistently until the end of the period of study, with a standardized rate in 2017 only 4% lower than in 2008. In the period, 20.6% of admissions were due to ACSC, ranging from 18.8% in 2011 to 24.1% in 2017. The model with year + year² as predictors explained 92% of the variability observed in standardized rates (Adjusted R² = 0.917; p < 0.001), with high statistical significance (p < 0.001) in both variables. The model with the year in three categories (2008-2010, 2011-2014, 2015-2017) explained 60% of the variability of the standardized rates (adjusted R² = 0.597; p = 0.02), with the middle period significantly different from the initial period (p = 0.006), but without statistical difference with the final period (p = 0.16), showing the improvement of the rates at the beginning of the period and a subsequent worsening, returning to the initial situation (Figure 1). The proportion of ACSC among hospitalizations was higher in 2017 than in 2008.

The crude rate of HACSC in the period was 5.7 cases per thousand inhabitants in males and 5.8 in females, although the standard rate by age group is slightly higher in men. The proportion of hospitalizations is similar between genders: in males, 20% of hospitalizations were due to ACSC, and 21% in females. The women presented ages from 0 to 109 years, mean of 40.4, a standard deviation of 30.0, and a median of 42 years. Men were aged from 0 to 117 years, mean 39.4, standard deviation 30.8, and median 44 years. Just under a quarter (23%) of hospitalizations for ACSC are under five years old, and 15% of children under two years old. The median age was 42 years and the 75th percentile was 67 years old. The median and mean age is higher in 2017, while decreasing the coefficient of variation, reflecting

population aging. From 70 years of age, the rate is considerably higher in men (Figure 2). The elderly are the age group that most benefited between 2008 and 2014, but in 2017 they already had rates close to those at the beginning of the period. Children had little improvement between 2008 and 2014 and the rates in 2017 were higher than at the beginning of the period (Figure 3).

Throughout the period, the most common causes of ACSC were: gastroenteritis and complications (15.6%), kidney and urinary tract infection (9.4%), asthma (9.2%), heart failure (8.8%), cerebrovascular (8.1%), diabetes mellitus (7.2%), bacterial pneumonia (6.7%), chronic obstructive pulmonary disease (6.1%), systemic arterial hypertension (5.4%), and skin and subcutaneous infection (5.2%). In the age group from 0 to 14 years, gastroenteritis significantly decreased from 2008 to 2014, decelerating but still decreasing in 2017, from 50.0% in 2008 to 25.9% in 2014 and 22.2% in 2017). Asthma was the second cause in this range, which continued to increase slightly from 17.2% in 2008 to 20.0% in 2014 and 22.5% in 2017. Bacterial pneumonia was the third most frequent cause in this range, with little variation (8.4% in 2008, 9% in 2014, and 9% in 2017).

In the age group of 15 to 49 years, gastroenteritis followed a declining trend (25% in 2008, 14% in 2014, and 11% in 2017). Urinary tract infection was the second most common cause in 2008 and 2014, and the first in 2017, in this age group (15.7% in 2008, 14.2% in 2014 and 16.4% in 2017). In this range, attention is drawn to the skin and subcutaneous tissue infection, which rises from 1.6% in 2008 to 7.8% in 2014 and 10.6% in 2017.

In the age group of 50 or more years, heart failure is the most frequent cause, but reducing from 17.8% in 2008, to 14.8% in 2014 and 13.9% in 2017. On the other hand, Cerebrovascular increased from 11.7% in 2008, to 16.1% in 2014 and 17.2% in 2017, and was the most frequent cause. Diabetes Mellitus is the third most common cause in this age group and also increased in the period, ranging from 10.9% in 2008 to 12.1% in 2014 and 13.4% in 2017 (Figure 5).

Discussion

The ESF has been proposed as a priority model for organizing PHC in several aspects, especially in improving accessibility and reducing inequities in less empowered groups of the population^{17,18}. Several studies have found an inverse association between HACSC and ESF coverage^{19,20}. However, in the period studied, ESF coverage in Sergipe remained above 80%, with little variation, suggesting that in this period the effectiveness of PHC can be better assessed by other aspects than ESF coverage. In other words, the changes observed in the period are not due to a change in the supply of the service in terms of population coverage.

In the initial phase of the study, from 2008 to 2014, we observed a decrease in HCASC in Sergipe, which corroborates studies of similar periods in other places such as Goiás (Mid-West region of Brazil) from 2005 to 2015, Pernambuco (Northeast region) from 2008 to 2012 and Espírito Santo (Southeast region) from 2000 to 2014^{21–23}. Our research showed a U-curve over time, starting in 2008 with a continued decrease in the HCASC rate until 2011, followed by a stabilization until 2014, the year in which it reached

a lower value. From then on, the indicator worsened, with a sharp increase in rates, which, at the end of the period, are similar to the beginning, showing a worsening of the advances achieved. The worsening occurs in all age groups, particularly among children, who have the HCASC rates in 2017 higher than in 2008. Statistical analysis showed that the values found at the end of the period are significantly different from the beginning, indicating that the behavior observed is not the result of random variation. The analysis also shows the aptness of the indicator to describe the outcome of health policies, which is consistent with the conceptual methodological framework that presents it with an indicator of the first level of the health system in all its scope, and not only of the care provided by the health team^{5,6}.

The public policies that preceded and contributed to the performance of the indicator throughout the study period began with the publication of the 2006 PNAB, which marks the transition from PSF to ESF *status*. Integrative and Complementary Health Practices (also called “Alternatives”) and the National Health Promotion Policy were also important milestones that year. In 2007, the Health at School Programme was created, and in 2008 the Family Health Support Centre (Núcleo de Apoio à Saúde da Família - NASF) was created. In 2011, the second edition of the PNAB, creation of the National Program for Improving Access and Quality of Basic Care (Programa Nacional de Melhoria do Acesso e da Qualidade da Atenção Básica - PMAQ) and creation of the Programs: Qualification of Basic Health Units; Better at Home; Academy of Health; of the teams of Clinic in the Street; of Telehealth Brazil Networks (Telessaúde Brasil Redes); and the review of the National Policy on Food and Nutrition. In 2012, there was the creation of the Basic Care Professional Valuation Program (Programa de Valorização do Profissional da Atenção Básica - PROVAB) and, in 2013, the More Doctors Program (Programa Mais Médicos - PMM) and the substitution of the Basic Care Information System by the e-SUS Basic Care and the Basic Care Health Information System (Sistema de Informação em Saúde da Atenção Básica - SISAB).

This entire set of federal government policies has invested in improving the structure and health process of care, and expanding the accessibility, resulting in better effectiveness of PHC. However, as of 2014, the Brazilian economic crisis had repercussions in the rate of unemployment and increased social inequality, financial cuts, and social instability²⁴, and the indicator began to assume the upward slope of the curve. In this regard, the approval of the Constitutional Amendment 95/2016 that establishes a spending cap in the next 20 consecutive years, along with environmental and educational policies will compromise the sustainability of the SUS and its constitutional premise of universal coverage and other attributes of the PHC^{24,25}. In 2017, there was the third edition of the PNAB, with major setbacks and reformulation in its political orientation, and withdrawal of financial incentives to the ESF, which is why it suffered severe criticism from the Brazilian scientific community^{25,26}.

The most frequent groups of causes in children up to 14 years old were gastroenteritis, asthma, bacterial pneumonia, and ear, nose, and throat infection. There was a significant decrease in gastroenteritis and complications, ranging from 50% of the HCASC in 2008 to 22% in 2017; asthma and pneumonia remained stable in the period. These causes were the same as those found in a study in Minas Gerais, Southeastern Brazil, for children and teenagers²⁷.

A study conducted in Sergipe from 2002 to 2012 on hospital admissions in teenagers showed a 143.1% reduction in HCASC²⁸. In the population of 50 or more years, the most frequent causes were heart failure, cerebrovascular diseases, diabetes mellitus, systemic arterial hypertension, nutritional deficiencies, and angina. A study conducted in Paraná, Southern Brazil, in the range of 60-74 years, presented similar results²⁰. The improvement observed in the indicator before the most pronounced political changes from 2014 onwards was mainly due to more effective attention to the population over 50 years of age. It is notable that even among the very elderly, rates improved a lot, and then worsened. These results show that the exclusion of the elderly in studies that address the HCASC can be a mistake, since it was shown that it responds to the political actions driving the PHC. Thus, we should continue analyzing the indicator with all age groups - consistent with the principles of universality, equity, and integrality of PHC.

This study has its limitations, most dependent on the quality of information, as it uses secondary data, and the fact that SUS, despite being an universal system, has not total coverage of the hospital admissions. So, it is important to emphasize that about 88% of hospital admissions in Brazil are through SUS²⁹. Nevertheless, the SIH-SUS has shown high reliability for the study of HACSC³⁰.

Conclusion

The investment in PHC from 2006 was followed by the improvement of its effectiveness, measured by the HACSC rates. The changes in the country's political direction from 2014 onwards were accompanied by the worsening of the effectiveness of PHC in the state of Sergipe, in both genders and all age groups, returning to the levels observed at the beginning of the decade. The improvement in the indicator following the implementation of policies to strengthen PHC and its worsening in response to the country's political and economic crisis demonstrates the damage to Sergipe people's health caused by policies to withdraw social rights and diminish the state, concerning the most common health problems. This study reports us to the need for a national study to evaluate the effects of national political changes on the whole Brazil, as well as its Regions and States.

Abbreviations

ACSC - Ambulatory Care Sensitive Conditions

AIH - Hospitalization Admission Authorization (Autorização de Internação Hospitalar)

ESF- Family Health Strategy (Estratégia Saúde da Família)

HACSC - Hospitalization for Ambulatory Care Sensitive Conditions

IBGE - Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística)

PACS - Community Health Workers Program (Programa de Agentes Comunitários de Saúde)

PHC - Primary health care

PMM - More Doctors Program (Programa Mais Médicos)

PNAB - National Basic Care Policy (Política Nacional de Atenção Básica)

PSF - Family Health Program (Programa Saúde da Família)

SHR - Standardized Hospitalization Ratio

SUS - Unified Health System (Sistema Único de Saúde)

WHO - World Health Organization

Declarations

Ethical approval

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Limitations

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Consent for publication

All authors agree with the decision to submit the article.

Availability of data and materials

The data described in this Data note can be freely and openly accessed on ftp.datasus.gov.br/dissemin/publicos/SIHSUS/200801_/Dados/.

Please see table 1 and references for details and links to the data.

Competing Interests

The authors declare that there is no relationships, conditions or circumstances that present a conflict of interest in the research.

Funding

The authors declare that there is no source of funding.

Authors contributions

JCM - Collaborated in the design of the project, writing of the article, analysis and interpretation of data, is responsible for all aspects of the work and in ensuring the accuracy and integrity of the entire work.

BKA - Collaboration: Collaborated in the design of the project, in the critical review and final approval of the version to be published and in ensuring the accuracy and integrity of the entire work.

NFB - Collaboration: Collaborated in the design of the project, in the analysis and interpretation of data, critical review and relevant intellectual content and in ensuring the accuracy and integrity of the entire work.

“all authors have read and approved the manuscript”

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Data description

Table 1: Overview of data file/data sets

| Label | Name of data file | file types (file extension) | Data repository |
|-------------------------|---------------------------------|--------------------------------|--|
| RDSE0801, ..., RDSE1806 | RDSE0801.dbc, ..., RDSE1806.dbc | DATASUS compressed file (.dbc) | ftp.datasus.gov.br/dissemin/publicos/SIHSUS/200801_/Dados/ |
| População | popSE.xlsx | MS Excel file (.xlsx) | Tabulated from http://tabnet.datasus.gov.br/cgi/defthtm.exe?ibge/cnv/projpopuF.deF |

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Figures

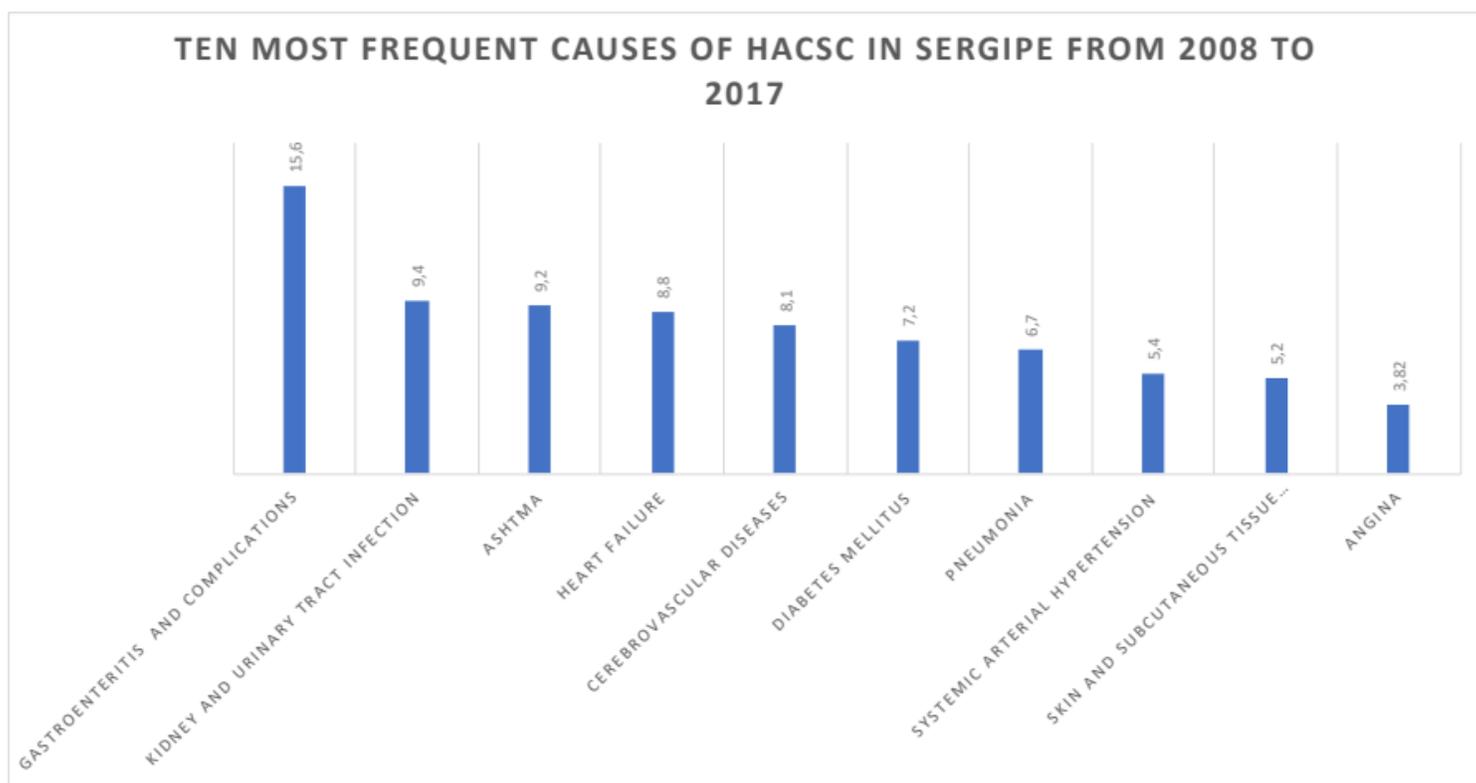


Figure 1

HACSC (Standardized Hospitalization Ratio - SHR), by year and gender in Sergipe, 2008-2017.

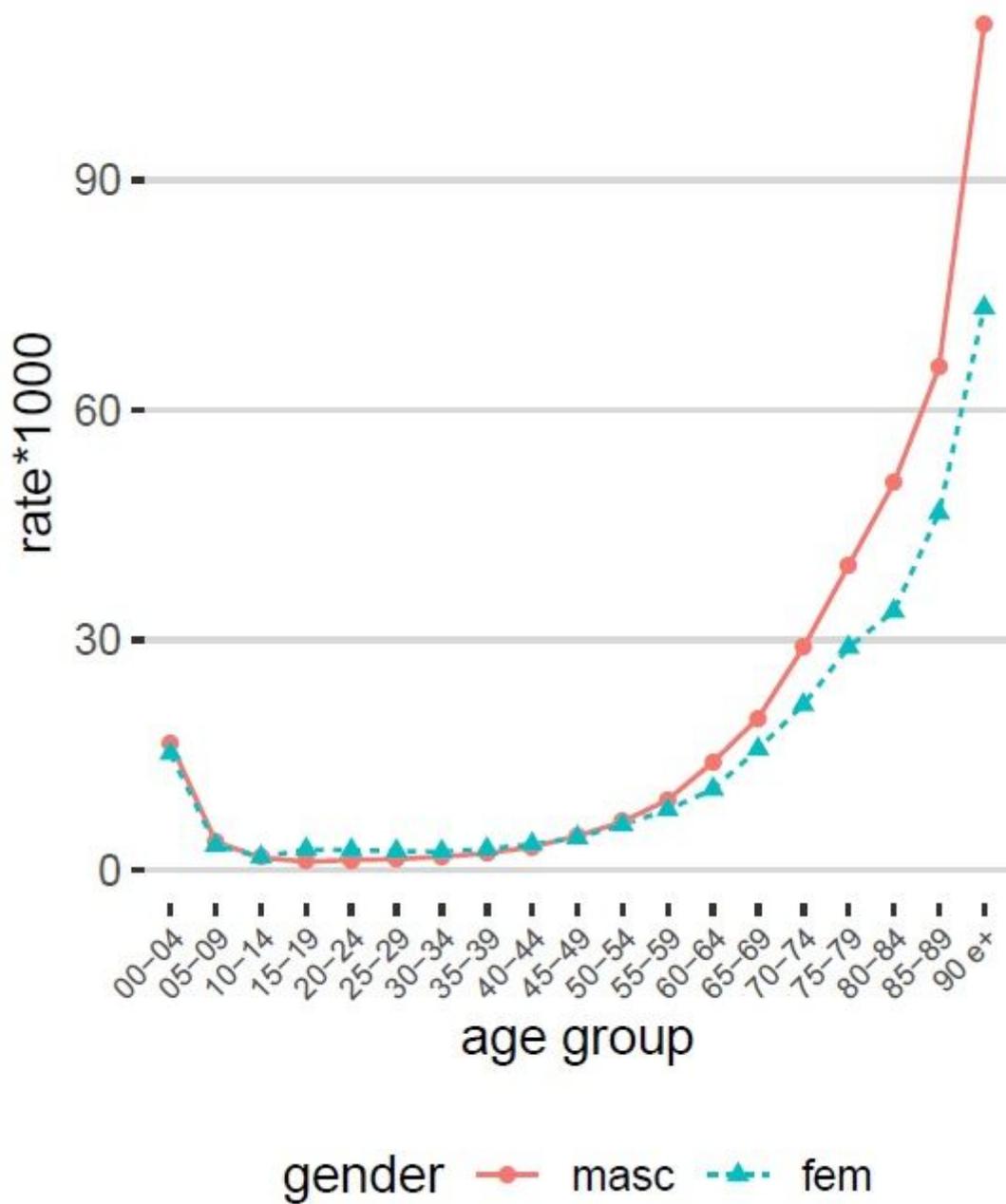


Figure 2

Hospitalizations for ambulatory care sensitive conditions (Rate by thousand inhab) by age group and gender in Sergipe 2008-2017.

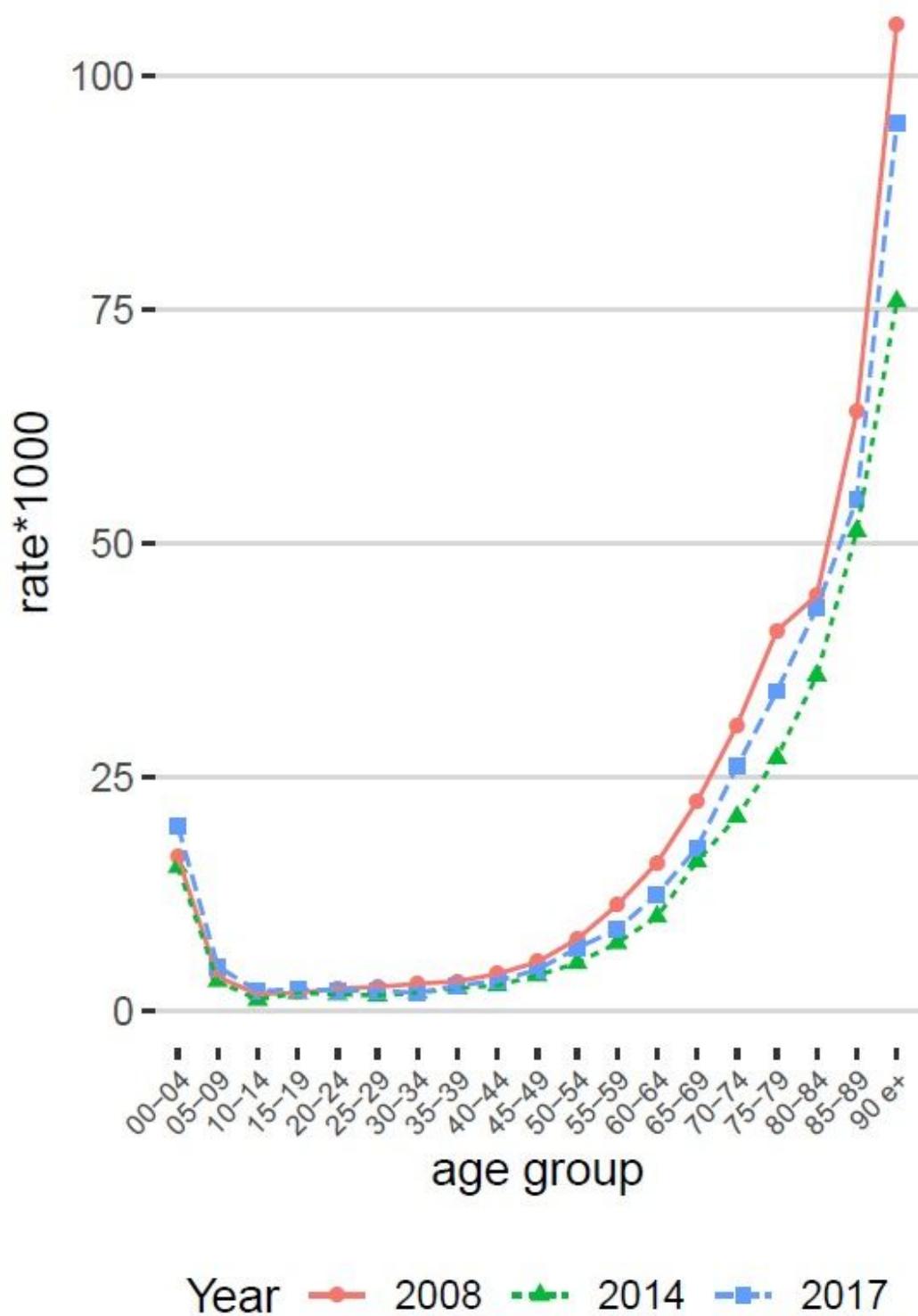


Figure 3

Distribution of hospitalizations for ambulatory care sensitive conditions rates per 1000 inhabitants, by age group in the years 2008, 2014 and 2017, in Sergipe.

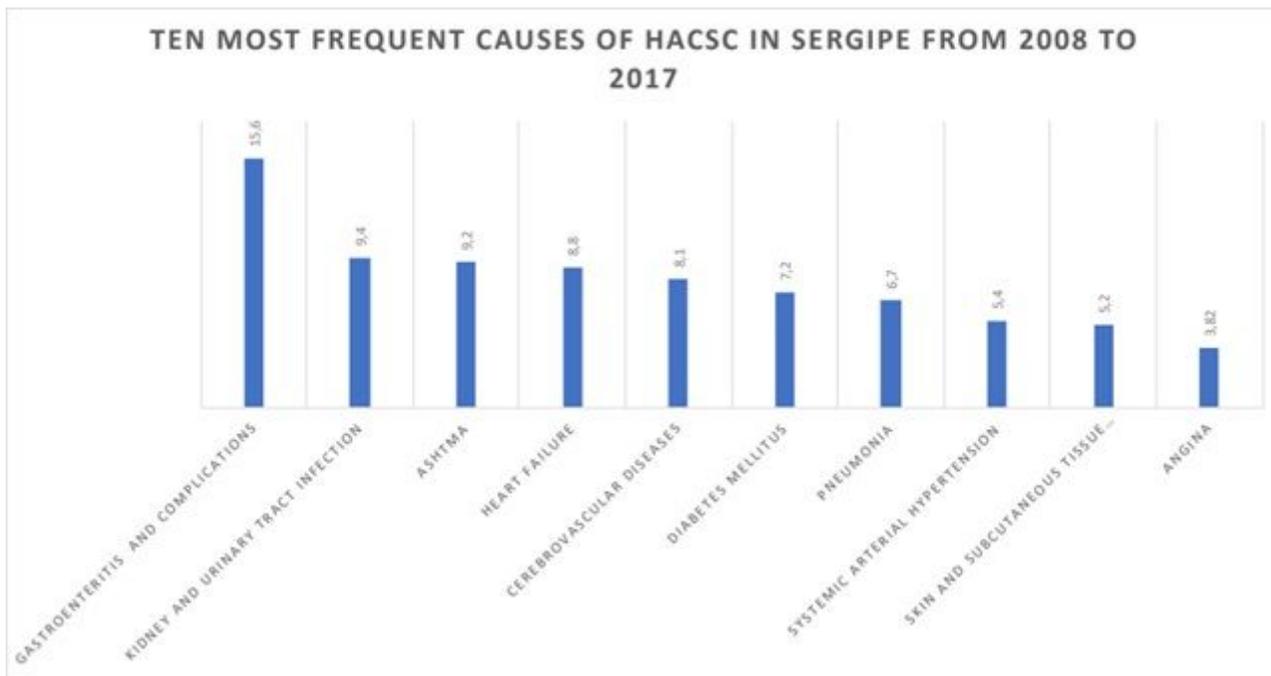


Figure 4

Distribution of the proportions of the ten most frequent causes of Hospitalizations for ambulatory care sensitive conditions in Sergipe from 2008 to 2017.

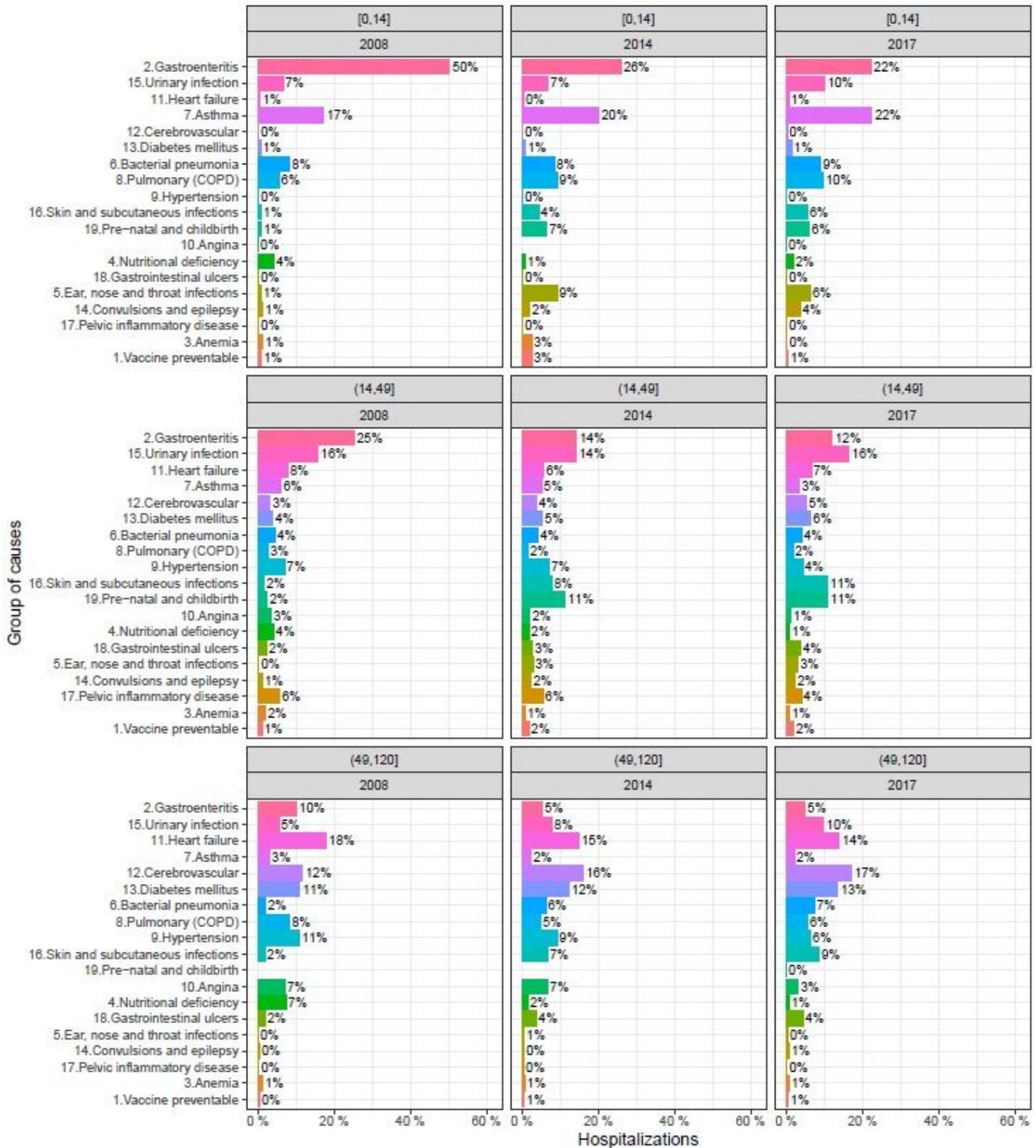


Figure 5

Distribution of Hospitalizations for ambulatory care sensitive conditions by group of causes and age group of 0-14 years, 15-49 years and 50-120 years in 2008, 2014 and 2017, in Sergipe.