

Expenditure trends in ambulatory care sensitive conditions in the under-fives in Bahia, Brazil

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Abstract *This study analyses expenditure trends in Hospitalizations for Ambulatory Care Sensitive Conditions (ACSCs) in children. It is an ecological time-series study, including hospitalizations of children under five in Bahia, between 2000 and 2012. We calculate the annual ACSC rates, as well as the total and average expenditure on these hospitalizations. We construct linear regression analysis models for the temporal trends. Between 2000 and 2012, 810,831 ACSC hospitalizations for the under-fives were recorded in Bahia. Hospitalization rates dropped 24.7% over this period, falling from 44.6 to 33.6 per 1,000 children. The total expenditure on such admissions is estimated to be 155.8 million Brazilian Reals. When we compare the first with the last year of the series, we note a reduction of 50.4% in total expenditure. The linear regression analysis demonstrates a reduction trend in average ACSC expenditure ($\beta = -1.20$, $p = 0.014$), ($\beta = -3.45$, $p < 0.01$) and total expenditure ($\beta = -0.46$, $p < 0.01$). Despite the reductions in these indicators, ACSC rates remain high, which has a significant impact on the volume of resources spent on avoidable hospitalizations. To this end, it is important to reduce ACSC expenditure, to both improve population health and reduce hospital costs.*

Key words *Hospitalization, Primary healthcare, Child health, Financial resources in health, Time series studies*

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Introduction

Hospitalizations for Ambulatory Care Sensitive Conditions (ACSCs) refer to a series of health problems in which effective primary care action may reduce the risk of hospitalizations¹. Specific interventions in Primary Healthcare (PHC), such as disease prevention, early diagnosis, the treatment of acute episodes and the monitoring of chronic diseases, may prevent ACSCs².

It is believed that avoidable hospitalizations reflect the healthcare system's failure to provide access to quality primary care services. It is further considered that, if such events are detected early and properly treated, reducing the severity of the clinical picture, the need for hospitalization can be reduced or avoided³. These primary healthcare failures are of paramount importance, given that the Unified Health Service (*Sistema Único de Saúde*: SUS) does not have a stable income adequate for its needs, and limited public resources are available to support the population's health⁴. In this sense, avoidable hospitalizations burden the public health budget and waste resources that could be used to fund other health activities.

In Brazil, studies of ACSCs increased in frequency following the Ministry of Health's initiative to create the Brazilian ACSC List, covering conditions that affect all age groups, from children to the elderly, and composed of 19 diagnostic groups⁵. In 2006, the estimated ACSC rate was 182.8 hospitalizations/10 thousand inhabitants, with marked inequalities across federal units, varying from 151.3/10 thousand inhabitants in Rio de Janeiro to 233.7/10 thousand inhabitants in Tocantins⁶. In 2007, 1.6 million hospitalizations for such conditions were recorded in the 20 to 79 year-old age range, representing 24.9% of total hospitalizations⁷.

In 2006, the main causes of hospitalization for those under five were infectious gastroenteritis and its complications, asthma and bacterial pneumonia⁸, results corroborated in other ACSC studies for this age group within specific contexts (municipalities or federal units)⁹⁻¹¹. Despite probable differences in the behaviour of the ACSC rate between age sub-groups (neonatal, post-natal, under 1, 1 to 4 years old), few studies describe their hospitalization features. In general, in ACSC analyses of the under-fives, we would expect higher percentages of avoidable hospitalizations in children under 1 year of age, given the biological vulnerability to disease at this age.

Beyond the impact of hospital admissions on health, which may also increase risk of mortality,

and on children's psychological characteristics, ACSCs in the under-fives also represent high expenditure affecting the financial management of SUS. Studies that estimate expenditure on these hospitalizations are also scarce and do not contain specific data for children's hospitalizations. In 2007, the total estimated expenditure on individuals aged between 20-79 years old was 820.17 million Brazilian Reals (R\$), representing 19.8% of total expenditure on such hospitalization in Brazil⁷.

Despite the financial impact of ACSC hospital admissions in terms of the management of resources allocated to SUS, studies that demonstrate the temporal trends of expenditure on such events in children remain scarce. In this sense, this research aims to analyse the trend for Hospitalizations for Ambulatory Care Sensitive Conditions and expenditure on such hospitalizations for children under five, resident in Bahia between 2002 and 2012.

Methods

This is an ecological time-series study, with its unit of analysis the State of Bahia between 2002 and 2012. Bahia is composed of 417 municipalities, its geographical area is more than 564 thousand km² and, according to the 2010 Census of the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*: IBGE), its 2010 population was over 14 million inhabitants¹².

During this period, the organization of health services in Bahia was distributed across 28 health regions. According to the National Health Facilities Registry, this network of services was served by 129,622 health professionals in 14,258 health facilities, with 26,186 SUS hospital beds¹³.

We analysed the hospitalizations of children under five years old, resident in Bahia, who were admitted within the SUS network between January 2000 and December 2012. We considered Hospitalizations for Ambulatory Care Sensitive Conditions to be those hospitalizations for any one of the diagnoses that form the 19 groups of causes on the Brazilian ACSC list, of which the most frequently observed in the under-fives were vaccine-preventable diseases, infectious gastroenteritis and its complications, nutritional deficiencies, bacterial pneumonia, asthma, lung diseases and pre-natal and childbirth related diseases⁵.

The study's dependent variables were: rate of hospital admissions for the set of Ambulato-

ry Care Sensitive Conditions, total expenditure on hospitalizations and average expenditure on hospitalization of the under-fives. The ACSC rates were calculated by dividing the number of hospitalizations in this age group resulting from diseases on the Brazilian ACSC List by the population of children under five, as estimated by the IBGE, then multiplying the result by 1,000. To define the total expenditure variable, we used data available from the Hospital Information System (*Sistema de Informação Hospitalar: SIH*) referring to the amount arising from Hospital Admission Authorizations (*Autorizações de Internação Hospitalar: AIH*), without detailing the procedures or supplies used, and referring to ACSCs in the under-fives in Bahia, between 2000 and 2012. We also calculated the average expenditure on hospitalizations for these conditions, which we obtained from the quotient between total expenditure and number of authorized admissions.

Our data source was the Ministry of Health's SIH, which is available for public consultation on the SUS Department of Information website (DATASUS - www.datasus.gov.br). Information regarding expenditure on such hospitalizations, as well as other information inputted into the SIH, was obtained from completed AIHs. In order to conduct our analysis, the values were corrected by the General Price Index (*Índice Geral de Preços: IGP-M*) of the Getúlio Vargas Foundation (*Fundação Getúlio Vargas: FGV*) adopting 2000 as the base year for calculation. We also calculated the percentage variations in ACSC rates and the total and average expenditure for the period studied.

The tabulation and extraction of SIH data was conducted using Tabwin software, version 3.6, provided by DATASUS. Once the database had been set up, the file was exported for statistical analysis by IBM's Stata software, version 12.0.

The statistical analysis initially involved a description of hospitalization rates and total expenditure, as well as the average expenditure on these hospitalizations. The Shapiro-Wilk test was then applied to assess the normality of data, which demonstrated that the rates and expenditure variables presented normal distribution. We then analysed the linear Pearson correlations between ACSC rates, total expenditure and average expenditure, and the variable for the year, in order to assess whether it was possible to use simple linear regression, and allowing a statistically significant correlation if the p value was equal to or below 0.05.

We applied linear trend analysis to ascertain the temporal trend for ACSC rates and total and

average expenditure. We estimated simple linear regression models, defined as: $Y = \alpha + \beta * \text{Year}$, where β was variation over the period. The linear regression results are presented in the form of the β coefficient, confidence interval 95% (CI 95%), significance level and adjusted R^2 . We applied the Breusch-Godfrey test to identify serial autocorrelation, taking a p value over 0.05 to signify that there was no autocorrelation and that linear regression would be sufficient to measure the variable's temporal trend.

Although this was an ecological study using secondary data from the public domain, it was approved by the Research Ethics Committee of the State University of Ceará, following all the recommendations of National Health Council Resolution 466/2012.

Results

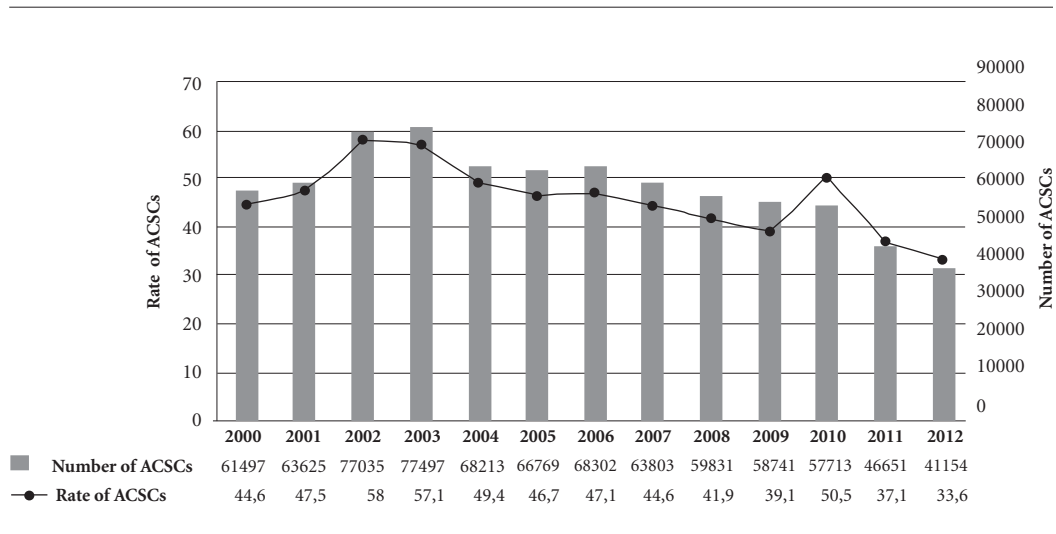
From 2000 to 2012, 810,831 notifications were made of hospital admissions for ACSCs in children under five years of age in Bahia. When we compared the first and last years in the historical series we observed a reduction of 33.1% in the number of hospitalizations. Following this trend, the ACSC rates fell by 24.7%, from 44.6 to 33.6 hospital admissions /1,000 children under five years of age (Graph 1).

The total expenditure on avoidable hospitalizations of the under-fives in the 13 study years was estimated at R\$ 155.8 million. Despite the high financial cost, we noted a reduction of 50.4% in total expenditure, when we compared 2000 to 2012. As well as total expenditure, the average expenditure on these hospitalizations fell 28.8%, from R\$ 235.10 at the beginning of the series to R\$ 167.50 in the last year of the study (Graph 2).

Linear regression analysis evidenced a reduction trend in ACSCs ($\beta = -1.20$; $p = 0.014$), average expenditure ($\beta = -3.45$; $p < 0.01$) and total expenditure ($\beta = -0.46$; $p < 0.01$) on these hospitalizations in the under-fives in Bahia over this period (Table 1).

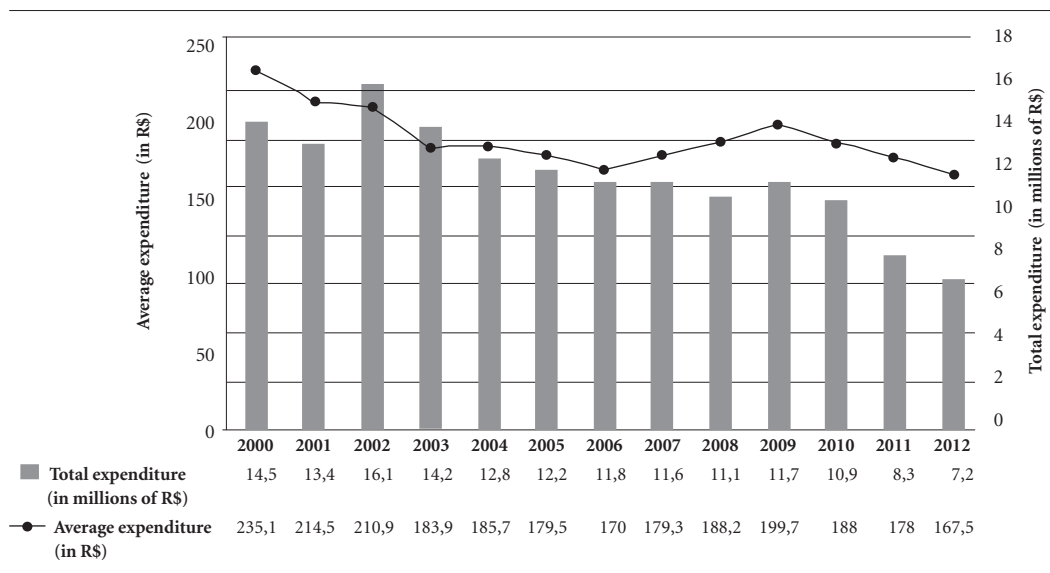
Discussion

This study demonstrated a reduction trend in the number and rates of ACSC hospitalizations in children under five years of age in Bahia over the 13 years investigated, accompanied by a reduction in total and average expenditure corresponding to these avoidable hospital admissions.



Graph 1. Number and rate of hospitalizations due to ACSCs in the under-fives, per 1,000 under-fives in Bahia, 2000-2012.

Source: DATASUS (2014).



Graph 2. Total expenditure (in millions of R\$) and average expenditure (in R\$) on hospitalizations for ACSCs in the under-fives in Bahia, 2002-2012.

Source: DATASUS (2014).

Over recent years, research at national level has also confirmed reductions in ACSC hospitalizations of children, with different reduction rhythms and patterns, in line with the specific-

ties of each scenario^{8,10,14-17}. On the international scene, systematic reviews have demonstrated a reduction in ACSC rates in a range of populations, including in the under-fives, and these effects

Table 1. Parameters obtained from simple linear regression models in order to estimate temporal trends in ACSC rates, average expenditure (in R\$) and total expenditure (in millions of R\$) on ACSCs in the under-fives in Bahia, 2002-2012.

Variables	β	CI 95%	p	Adjusted R2
ACSC rate *	-1.20	-2.11; -0.30	0.014	0.385
Average Expenditure (in R\$)**	-3.45	-5.82 ; -1.07	0.009	0.434
Total Expenditure (in millions of R\$)***	-0.56	-0.73; -0.38	<0.001	0.800

Source: Research Data (2014)

* Breusch-Godfrey Test = 0.732; Equation: ACSC Rate = 53.16 - 1.2 Year. ** Breusch-Godfrey Test = 0.055; Equation: Average Expenditure = 211.5 - 3.45 Year. *** Breusch-Godfrey Test = 0.541; Equation: Total Expenditure = 15.3 - 0.56 Year.

have principally been attributed to an expansion of Primary Healthcare Services^{18,19}. In spite of the extensive international scientific research regarding avoidable hospitalizations, studies that analyse the trends in total and average expenditure on such hospitalizations, particularly of children, remain scarce.

In Brazil, some evidence suggests that the Family Health Strategy (*Estratégia Saúde da Família*: ESF) is potentially significant in reducing child morbidity and the severity of health problems that most frequently affect children, of which ACSCs constitute one indicator^{9,10,20,21}. This suggests a need to increase activities and financial investment in primary healthcare, in order to further reduce avoidable hospitalizations and those diseases that affect the child population.

A recent study of ACSCs in children under five also demonstrated that an increase in ESF coverage was a protective factor against ACSCs, even in municipalities with intermediary coverage. For the authors of this study, improvements in social conditions and increased ESF coverage may have simultaneously influenced the reduction in ACSCs. Changes to the healthcare model towards primary healthcare may have contributed to improvements in living conditions and in the target population's general health¹⁷.

Beyond the effects of an expansion of PHC services on reduced hospitalizations for avoidable causes, ACSC admissions are also influenced

by other determinants, such as demographic characteristics, socio-economic status, urbanization, life style and environment²². In this sense, access to education, income, decent housing conditions and basic sanitation may also influence ACSCs²³.

We note that, despite the reductions in Bahia, this study demonstrated that the ACSC rates at the end of the series remained high, which has important repercussions on the amount of funds spend on avoidable hospitalization causes in the under-fives. Despite the relevance of analysing expenditure on such hospitalizations for the rational management of health resources, only a few works describe and/or analyse the trends and magnitude of expenditure on these hospitalizations, specifically for population sub-groups, such as the under-fives, hampering comparison between this and other studies.

In regards to expenditure on ACSCs, Dias-da-Costa et al.²⁴ studied avoidable hospital rates in association with the quality of primary healthcare in Pelotas, Rio Grande do Sul, and found that the amount spent on these hospitalizations accompanied a fall in ACSC percentages and rates. In 1997, ACSC hospitalizations were responsible for 15% of expenditure on hospital admissions in Pelotas, while in 2003, this percentage fell below 5%. For the authors, savings on such avoidable hospitalizations provide a real possibility of reversing and redirecting these funds towards improving the effectiveness of primary healthcare.

Hospitalizations require high expenditure on the part of the health system, while hospitalizations arising from causes that could be avoided not only burden the system unnecessarily, but also perversely affect those that most require them²⁵. In this case, we note that, beyond the financial impact, we should consider the psychological and social damage done to children below five years of age when subject to hospital admission as a result of being denied appropriate care at primary level.

When considering the study's limitations, we should mention the problems inherent in using health information systems, given the possibility of failures in their inputting/functioning, which may generate underreporting, or lack of homogenization to the parameters used for the classification of diseases²⁶. Despite these limitations, there is a substantial set of scientific evidence that suggests consistency and validity in the use of the Hospital Information System, given improvements in the quality of its completion and

its expanded use in research in the field of Collective Health²⁷⁻²⁹.

Analysing expenditure in historical series presents challenges to researchers when comparing amounts over time, given inflationary variations and other economic characteristics. The correction option, which in this study was made in line with an economic index, seeks to minimize this problem and facilitate comparisons. Another element worth highlighting was the methodological care taken when using linear regression to assess trends, here only used once its validity had been evaluated according to statistical assumptions.

By taking the object of analysis to be not only number of avoidable hospitalizations but also their cost, which may equally be avoided or minimized, our study was able to demonstrate

the double benefit of addressing this problem. Thus, reducing and/or avoiding ACSCs may have an effect on improved population health, in that reducing hospitalizations potentially reduces risk of mortality, while, at the same time, having repercussions on reductions in hospital expenditure, which may contribute to balancing public accounts and the more rational use of health resources.

Our results indicate the need to reinforce primary healthcare activities, in particular the Family Health Strategy, and to strengthen public policy to combat the social problems that determine the populations health status, aimed at further reducing the incidence of such admissions and their cost, while having repercussions on quality and resolute healthcare for children.

Collaborations

All the authors listed contributed significantly to the production of the manuscript. EP Pinto Júnior participated in the design and design, the analysis and interpretation of the data, the writing of the article and approval of the version to be published. LQ Costa participated in the interpretation of the data, the writing of the article and approval of the final version to be published. SMA Oliveira participated in the interpretation of the data, writing of the article and approval of the final version. MG Medina participated in the writing of the article, critical review, and approval of the final version. R Aquino participated in the study design, data analysis and interpretation, critical review and final version approval. MGC Silva participated in the design and design, data interpretation, critical review and approval of the final version.

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