Original Article

Hospitalization for Ambulatory Care Sensitive Conditions in children under five years old in Santa Catarina State, Brazil, 2012: a descriptive study*

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Abstract

Objective: to describe proportions and rates of hospitalization for Ambulatory Care Sensitive Conditions (ACSC) among children under 5 years old, in Santa Catarina State, Brazil, 2012. **Methods**: this is a descriptive study using Brazilian National Health Service Hospital Information System (SIH/SUS) data, classified according to the Brazilian ACSC List. **Results**: a total of 32,445 children aged <5 years old were hospitalized, 25,7% of whom were ACSC cases, representing a rate of 20.1/1,000 inhabitants in the same age group; the main causes were infectious gastroenteritis and complications (26.7%), bacterial pneumonia (22.2%) and pulmonary diseases (16.9%); there was a higher hospitalization rate due to ACSC in males (21.1/1,000), and in children <1 year old (43.8/1,000). **Conclusion**: The results showed that the State of Santa Catarina had lower rates and proportions than those found in other Brazilian studies, even though ACSC were the cause of one quarter of hospitalizations in children aged <5 years.

Keywords: Primary Health Care; Epidemiology, Descriptive; Hospitalization; Pediatrics; Health Status Indicators.

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Introduction

The effectiveness of Primary Health Care (PHC) is of great interest to health service managers, health professionals and citizens. With the intention of verifying whether PHC has played its role with promptness and effectiveness, instruments are needed capable of evaluating this in a simple and concise manner.[1] The indicator for hospital admission for Ambulatory Care Sensitive Conditions (ACSC) has been one of these instruments used to measure the capacity to solve health problems at the first level of care of a health system.[2] ACSC have been defined since the early 1990s as health conditions of interest to timely and effective PHC, capable of reducing the risk of hospitalization through disease prevention as well as through control and management of acute episodes of chronic diseases.[3]

In 2005, the process began of building the Brazilian List of Hospitalizations due to ACSC based on a survey of corresponding national and foreign lists, meetings for drafting and review, validation by the Brazilian Society of Family and Community Medicine and, between October and November 2007, its being made available for public consultation.[4] Finally, Ministry of Health Ordinance SAS/MS No. 221 of 17 April 2008, instituted the Brazilian List of Hospitalizations due to ACSC, comprised of 19 groups of health problems.[5]

> *The description of hospitalizations according to Ambulatory Care Sensitive Conditions allows health service managers to establish priority regions or municipalities for the establishment of policies for better organization of Primary Health Care.*

The literature review performed by the authors of this article by searching the Pubmed, Lilacs and Scopus databases, among others, found 25 foreign articles published between 1996-2016, and 25 Brazilian articles published between 2008-2016, which addressed pediatric hospitalizations due to ACSC.[6] These studies indicated significant differences in the rates of hospitalization due to ACSC according to age groups, with higher prevalence and/or incidence in younger children.[6,7] High rates of hospitalization due to ACSC in an area or population subgroup may indicate serious problems of access or operation of outpatient care.[8] Brazilian studies show that the risk of hospitalization due to ACSC in children under 5 years old is higher when compared to individuals aged 5-59 years old.[9] The clear protagonism of high rates of hospitalization due to ACSC in children under 5 years old is a compelling reason for it being studied in this population.[10,11] No research was found in Santa Catarina State on pediatric hospital admissions due to ACSC registered using any of the codes of the Brazilian List of Hospitalizations due to ACSC. The description of hospitalizations according to ACSC allows health service managers to establish priority regions or municipalities for the establishment of policies for better organization of Primary Health Care.

The objective of this study was to describe the hospitalization proportions and rates for ACSC in children under 5 years old in Santa Catarina State, Brazil, in 2012.

Methods

This is a descriptive study of hospitalization proportions and rates for ACSC in children under 5 years old residing in Santa Catarina State in 2012.

According to data from the 2010 census, Santa Catarina had 6,248,436 inhabitants, 84% of whom lived in urban areas.[12] Approximately 80% of the state's 293 municipalities had less than 20,000 inhabitants. The proportion of children under 5 years old decreased from approximately 11.2% of the total population in 1990, to 6.5% in 2010.[12] The state has nine health macroregions (*Extremo Oeste*, *Meio Oeste*, Planalto Norte, Nordeste, Vale do Rio Itajaí, Foz do Rio Itajaí, Grande Florianópolis, *Planalto Serrano* and *Sul*), structured and organized to meet the demand for medium and high complexity health care.[13]

The total number of hospitalizations per municipality of residence and the epidemiological characteristics analyzed were obtained from the Inpatient Hospital Authorizations (IHA) paid and recorded on the Hospital Information System of the Brazilian National Health System (SIH/SUS), available at the Brazilian National Health System IT Department (DATASUS) website. The IHA of patients admitted to hospital in 2012 were included in the study, even though some of these admissions were only recorded in 2013: for example, some IHA for people admitted to SUS hospital units in December 2012 were only included on the

database in May 2013. Facts like these occur due to errors or inconsistencies when filling in the IHA and these are returned to the professional who signed it for correction. This procedure can take months, given the time taken for the IHA to be returned by the Ministry of Health and sent back again. For this reason the period covered by the search for 2012 IHAs was extended until June 2013. Notwithstanding, analysis was only performed on the hospitalizations of children under 5 years old residing in Santa Catarina State between 1 January and 31 December 2012.

Classification as an Ambulatory Care Sensitive Condition followed the Brazilian List of Hospitalizations due to ACSC, instituted by the Brazilian Ministry of Health in 2008. This list is comprised of 19 groups of causes of hospitalization, based on International Statistical Classification of Diseases and Related Health Problems – 10th Revision (ICD-10).[5]

A consistency test was performed on the data to check the number of hospitalizations due to ACSC in children under 5 years old between 2007 and 2012. The consistency test has the purpose of identifying discrepancies in the number of hospitalizations as this can alert as to possible system errors or fraud. Hence why the period of 5 years prior to the year studied was chosen. If the difference between the number of ACSC hospital admissions invoiced for a given year was greater than twice the previous year, each month of that year would be analyzed. As the year considered for study was only 2012, all the months of that year were analyzed. It was found oted that the municipalities of Anchieta (6,172 inhab.), Braço do Trombudo (3,498 inhab.), Lageado Grande (1,478 inhab.), Mirim Doce (2,477 inhab.), Palmeira (2,410 inhab.), Passo de Torres (6,964 inhab.) and Presidente Nereu (2,281 inhab.) did not record any hospitalizations for ACSC in children under 5 years old in 2012. However, children from Santa Catarina under 5 years may have been admitted in hospitals in other states, given that this study's search was limited to hospitalizations in Santa Catarina.

The size of the resident population in the age range studied was obtained from a population estimate for 2012, based on the 2010 Brazilian Institute of Geography and Statistics (IBGE) census. Hospitalization, proportions were calculated by taking the quotient between the number of ACSC hospitalizations and the total number of hospitalizations, multiplied by 100. Hospitalization rates were calculated by taking the quotient between the number of ACSC hospitalizations and the total number of inhabitants, multiplied by 1,000. For the overall results, the numerator and the denominator corresponded to the total number of children aged up to 5 years old. For specific results, the numerator and the denominator corresponded to (i) sex (male; female), (ii) age range (less than 1 year and 1 to 4 years of age), (iii) groups of causes of hospitalization (infectious gastroenteritis and complications; bacterial pneumonia; pulmonary diseases; asthma; kidney and urinary tract infection; epilepsy; skin and subcutaneous infection; ear, nose and throat infections; vaccine-preventable diseases and sensitive conditions; nutritional deficiencies; prenatal and childbirth-related diseases; heart failure; diabetes mellitus; anemia; gastrointestinal ulcer; cerebrovascular diseases; hypertension; female pelvic organs inflammatory disease; and angina) and (iv) health macroregions.

The hospitalization rates were standardized by sex and age range using the indirect method. As the correlation between the standardized hospitalization ratio and the raw rates was high (Pearson correlation coefficient=0.99), standardization was considered unnecessary and the raw rate was examined.

The compressed IHA files were expanded from. DBC format to. DBF format using the TabWin program. Data processing and statistical analyses were performed using Stata version 14.2. The geographical map of distribution of rates was drawn usingthe program R, with the aid of the tmap and tmpatools packages.

The information used are of public domain with no individual identification. The study project, in accordance with National Health Council Resolution (CNS) No 466 of 12 December 2012, was exempt from submission to an Ethics Research Committee.

Results

In the year 2012, a total of 32,445 hospitalizations were recorded for children under 5 years old residing in Santa Catarina State, (78.2 per 1,000 inhab.); 25.7% of these hospitalizations were due to ACSC (20.1 per 1,000 inhab.) (Table 1). Figure 1 shows the geographical distribution of ACSC hospitalization rates in children under 5 years old, mostly concentrated in the state's central region.

The three major groups of causes of hospitalization identified due to ACSC were infectious gastroenteritis

and complications (26.7%), bacterial pneumonia (22.2%) and pulmonary diseases (16.9%); this set of groups corresponds to approximately two-thirds of hospitalizations due to ACSC in children under 5 years old in Santa Catarina State. The proportion of infectious gastroenteritis and complications was approximately 20.0% higher in relation to the proportion of bacterial pneumonia among those hospitalized due to ACSC (Table 1).

The proportion of hospitalizations due to ACSC was 12.0% higher in female children, compared to those of the male sex. In the case of children between 1 and 4 years old, this proportion was 25% higher, compared to children aged under 1 year old.

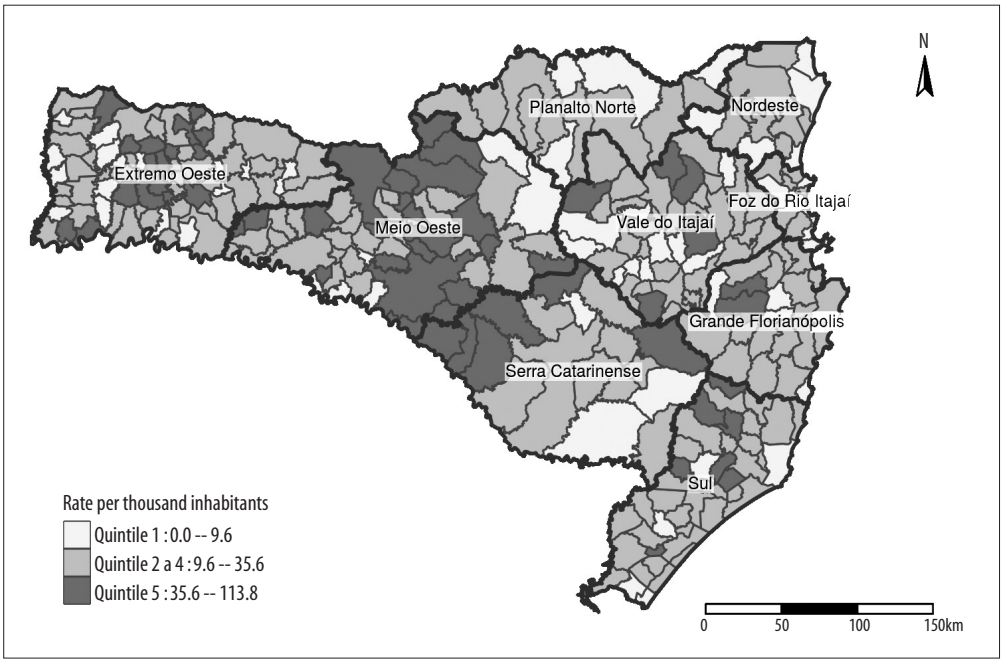
The Midwest (*Meio Oeste*) macroregion had the highest ACSC hospitalization proportion and hospitalization rate, whereby the proportion was 2.8 times higher and the rate was 3.5 times higher than the proportion and the rate found in the Foz do Rio Itajaí health care macroregion, where the state's lowest values were found. The *Planalto Serrano* macroregion had the second highest rate and the third largest proportion of ACSC hospitalizations, while the Southern (*Sul*) macroregion had the third highest rate and the second largest proportion (Table 2).

The ACSC hospitalization rate in male children was approximately 11.0% higher (21.1 per 1,000 inhab.) in relation to female children (19.1 per 1,000 inhab.). Regarding the age range, the ACSC hospitalization rate was approximately three times higher in children aged under 1 year old, in relation to children aged 1 to 4 years old (Table 2).

Table 1 – Number of hospitalizations in children under 5 years old, hospitalization proportions and rates for Ambulatory Care Sensitive Conditions (per 1,000 inhabitants), according to cause group and other hospitalization causes, Santa Catarina, 2012

ACSC hospitalization cause group[a,b]	N	Total %	ACSC %	Rate
Infectious gastroenteritis and complications	2,230	6.87	26.72	5.38
Bacterial pneumonias	1,854	5.71	22.21	4.47
Pulmonary diseases	1,413	4.36	16.93	3.41
Asthma	663	2.04	7.94	1.60
Kidney and urinary tract infections	548	1.69	6.57	1.32
Epilepsies	434	1.34	5.20	1.05
Skin and subcutaneous infection	378	1.17	4.53	0.91
Ear, nose and throat infections	328	1.01	3.93	0.79
Vaccine-preventable and sensitive conditions diseases	214	0.66	2.56	0.52
Nutrition deficiencies	130	0.40	1.56	0.31
Prenatal care and childbirth related diseases	39	0.12	0.47	0.09
Heart failure	36	0.11	0.43	0.09
Diabetes *mellitus*	31	0.10	0.37	0.07
Anemia	19	0.06	0.23	0.05
Gastrointestinal ulcer	13	0.04	0.16	0.03
Cerebrovascular diseases	10	0.03	0.12	0.02
Hypertension	4	0.01	0.05	0.01
Female pelvic organs inflammatory disease	2	0.01	0.02	0.00
Angina	1	–	0.01	–
Total per ACSC[a]	8,347	25.73	100.00	20.13
Other causes	24,098	74.27	–	58.12
Total	32,445	100.00	–	78.25

a) ACSC: Ambulatory Care Sensitive Conditions.
b) Ministerial Ordinance SAS/MS No 221, 04/17/2008.



Note: The divisions between the health macroregions of Santa Catarina are shown by the thicker lines.

Figure 1 – Geographical distribution of hospitalization rates for Ambulatory Care Sensitive Conditions in children under 5 years old (per 1,000 inhabitants), by municipalities, Santa Catarina, 2012

Discussion

In Santa Catarina, in 2012, approximately 1 in every 50 children residing in the state was admitted to hospital for causes that could have been avoided if there the health care system functioned better at its first level of care. Considering the capacity of PHC to solve the health needs of the population, roughly a quarter of hospitalizations of children under 5 years old would be avoided if this care were provided in an effective manner at the appropriate time. The hospitalization rate was higher in male children aged less than 1 year old living in the Midwest macroregion. The main causes of hospitalization due to ACSC in children under 5 years old were infectious gastroenteritis and complications, bacterial pneumonia and pulmonary diseases.

Compared with the states of Piauí (61/1,000 inhab. in 2010), Espírito Santo (31/1,000 inhab. in 2009) and Pernambuco (62/1,000 inhab. in 2009), Santa Catarina had a lower ACSC hospitalization rate in children under 5 years old.[14-16] A study conducted in South Carolina, United States of America (USA), found a hospitalization rate of 25/1,000 inhab. in 1995.[10] An analysis of hospitalizations in 2010 in Ecuador, using the Brazilian ACSC list, showed a higher risk of hospitalization in children aged under 1 year old in relation to the 1 to 4 year age range.[17] In our present study, the proportion ACSC hospitalizations of children aged 1 to 4 years was 25% higher in relation to hospitalizations of children under 1 year old. The hospitalization rate among children under 1 year old was three times higher than in the 1-4 years age group and was similar to that found in other places in Brazil.[14,18,19] In Valencia, Spain, children aged between 2 and 4 years old had an odds ratio of 0.50 (0.29-0.84), compared to those with less than 1 year of life.20 For these children, the higher hospitalization rate would be justified by the higher susceptibility to infections, and a greater tendency of referrals for hospitalization by health professionals.[20] Without the proper approach in PHC, these children would be more susceptible to the damaging consequences of possible failures in the system. In the literature, the male sex is associated with a greater probability of hospitalization due to ACSC in the pediatric population.[10,21] A study based on the 2006 National Survey on Demography and Health of Women and Children[21] in relation to

Table 2 – Absolute and relative frequencies and hospitalization rates for Ambulatory Care Sensitive Conditions (per 1,000 children under 5 years old), according to sex, age range and health care macroregion, Santa Catarina, 2012

Variables	N	%	ACSC[a] %	Rate
Sex				
Female	3,881	46.50	27.37	19.10
Male	4,466	53.50	24.45	21.12
Age group (in years)				
1 year	3,795	45.47	22.92	43.76
1-4	4,552	54.53	28.65	13.88
Health care macroregion				
Meio Oeste	1,510	18.09	37.14	37.10
Sul	1,496	17.92	32.07	25.60
Vale do Itajaí	1,067	12.78	21.96	17.71
Nordeste	1,038	12.44	23.38	17.03
Extremo Oeste	952	11.41	22.57	20.15
Grande Florianópolis	900	10.78	26.27	14.48
Planalto Serrano	596	7.14	29.95	30.24
Foz do Rio Itajaí	421	5.04	13.39	10.63
Planalto Norte	367	4.40	22.39	14.35
Total	8,347	100.00	25.73	20.13

a) ACSC: Ambulatory Care Sensitive Conditions.

children under 2 years old hospitalized due to ACSC in the previous year, found a prevalence ratio of 1.47 (p=0.004) for the male sex; in Valencia, however, the odds ratio of hospitalization due to ACSC in boys was 0.60 (0.41-0.89) for the population under 15 years of age.[20] In our study, the rate for males was 11% higher, although the proportion of ACSC hospitalizations of boys was 11% lower. In South Carolina, hospitalizations due to ACSC in those aged under 18 years weres found to be around 4% lower for males.[10]

In the Midwest health care macroregion of Santa Catarina there was a higher proportion of ACSC diagnosis among those hospitalized and higher ACSC hospitalization rate. The explanation for this finding may be found in the association between high rates of ACSC hospitalization and smaller population size.[22,23] The median population size of the municipalities in the Midwest macroregion of Santa Catarina is 4,632 inhab. (being the second lowest municipal population size after the *Extremo Oeste* health care macroregion with a median of 4,328.5 inhab.). This, in turn, may be related to the so-called "Roemer's law" - "A hospital bed built is a filled bed." -, which points to the use of vacant hospital beds regardless of the population's need.[24] A study in 2010 about the association between hospital bed availability and hospitalization rates in Michigan state, USA, provides strong evidence of the "Roemer's law" by demonstrating consistent positive association between the leves of aggregation levels for ACSC hospitalization rates, myocardial infarction, cerebral vascular accident and pelvic fracture, health plan coverage, proportion of African Americans, high income and education, and greater morbidity.[24] Other possible explanations for this finding may be related to economic, political-administrative, structural and health work process characteristics, among others.[2,9,23,25]

Bacterial pneumonia is the leading cause of hospitalization due to ACSC in Brazil.[9,25] In the U.S. State of South Carolina, the main cause of hospitalization due to ACSC was bacterial pneumonia in children younger than 18 years old, with a rate of 2/1,000 inhab. for residents in more affluent areas and 5/1,000 inhab. for the poorest areas.[10] In children under 5 years

old, the 'infectious gastroenteritis and complications' group of causes presents itself as the main problem of hospitalization due to ACSC in Brazil,[26] in line with the results of our study and those found for the states of Piauí, Espírito Santo and Pernambuco.[14-16] In Ecuador, gastroenteritis was the main cause of hospitalization due to ACSC nationwide and accounted for 65% of ACSC in children under 5 years old.[17] The occurrence of infectious gastroenteritis and complications is associated with the health infrastructure of the place where the family lives, while hospitalization due to these causes indicates late care for dehydrated children, i.e., a PHC failure.[21]

A limiting factor for the analyses of this study lies in the fact of only being able to take into account data about hospitalizations in SUS-managed or SUS-outsourced health care services. Despite this, 70% of Santa Catarina residents are admitted to hospital via SUS,[27] thus allowing the results found to be applied to PHC management in the state. Another point to discuss refers to the quality of available information. It has to be admitted and even emphasized the biggest problems of data reliability include the possibility of fraud aimed at increasing financial reimbursement for hospitalizations. However, ever since the creation of SUS there has been recognized progress with regular auditing the system and this has minimized this problem.[28] A study on the reliability of ACSC diagnosis records held on SIH/SUS concluded that they are valid, having found a substantial to almost perfect conformity (k=0.784), sensitivity of 78.2% and specificity of 97% between IHA and hospital medical records.[29] Another limitation was the use of Santa Catarina State IHA only, without accounting for children under 5 years old living in Santa Catarina but admitted to hospital due to ACSC in other states of the country. It is assumed that these hospitalizations are not significant for the study, given the total number of hospitalizations analyzed.

The basis of the indicator for ACSC hospitalization lies in the high problem-solving capacity of PHC, attributable to health promotion, prevention and outpatient treatment measures, which should lead to a decrease in hospitalizations due to early detection and control of diseases at less advanced stages.[2,30]

This study has contributed to the knowledge of the ACSC hospitalization profile in children under 5 years old in Santa Catarina State in 2012. Santa Catarina had the lowest hospitalization rate, compared to three other states of the country analyzed by other studies. Among children who were hospitalized, there was a greater proportion of ACSC diagnoses among girls and children aged 1 to 4 years old. A higher ACSC hospitalization rate was found among male children and children under 1 year old. The main group of ACSC causes was infectious gastroenteritis, in keeping with other studies, which suggests the need for investigations regarding the coverage of basic sanitation, distribution of oral rehydration solution and the approach to treatment opportunities for dehydrated children. The *Meio Oeste* microregion of Santa Catarina state hadthe highest ACSC hospitalization proportions and rates in children under 5 years old, possibly as a result of the high concentration of small-sized municipalities in that health care macroregion. This information about the epidemiological characteristics of ACSC hospitalizations in the pediatric age group can assist in the planning of specific and problem-solving actions, towards better Primary Health Care in the municipalities of Santa Catarina state.

Authors' contributions

Mariano TSO obtained, analyzed and interpreted the data and drafted the preliminary version of the manuscript. Nedel FB was responsible study conception and collaborated with obtaining, analyzing and interpreting the data and with the critical review of the manuscript. Both authors have approved the final version and declared themselves to be responsible for all aspects of the study, ensuring its accuracy and integrity.

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