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Internações por condições sensíveis à Atenção Primária à Saúde em crianças menores de 1 ano no Brasil

Primary care-sensitive hospitalization conditions in children under the age of 1 in Brazil

Elzo Pereira Pinto Junior (https://orcid.org/0000-0002-6977-2071) [1]
Rosana Aquino (https://orcid.org/0000-0003-3906-5170) [1]
Inês Dourado (https://orcid.org/0000-0003-1675-2146) [1]
Líllian de Queiroz Costa (https://orcid.org/0000-0001-9849-6339) [2]
Marcelo Gurgel Carlos da Silva (https://orcid.org/0000-0003-4030-1206) [2]

Abstract *Primary care-sensitive condition hospitalizations (PCSCH) are an essential health care indicator. This ecological, time-series study aimed to analyze the time trend of PCSCH in children under the age of 1 in Brazil, considering the age subcomponents of newborns and post-newborns. The PCSCH rates were calculated for infants under the age of 1 and in the neonatal and postneonatal subgroups. The Prais-Winsten generalized linear analysis model and the Annual Percent Change (APC) calculation were used to evaluate the time trend. The results showed that infectious gastroenteritis represented the most important cause of hospitalizations due PCSCH in children under the age of 1. Congenital syphilis and other congenital infections accounted for the highest proportion of hospitalizations in newborns, whereas gastroenteritis prevailed in post-newborns. An increase in newborn hospitalization rates and a decrease in hospitalization rates in both the postneonatal group and the group of children under the age of 1. Differences in trends in these hospitalization rates may reflect the influence of specific determinants on the risk of hospitalization in each age subcomponent.*

Key words *Primary Health Care, Child Health, Hospitalization, Time-Series Studies, Ecological Studies*

[1] Instituto de Saúde Coletiva, Universidade Federal da Bahia. R. Basílio da Gama s/n, Caneta. 40110-040 Salvador BA Brasil. elzojr@hotmail.com
[2] Programa de Pós-Graduação em Saúde Coletiva, Universidade Estadual do Ceará. Fortaleza CE Brasil.

Introduction

Primary care-sensitive conditions are defined as a set of diseases and conditions whose hospitalizations are preventable if the actions developed within primary health care (PHC) are provided timely and have a resolving character[1]. In Brazil, a list of causes of primary care-sensitive condition hospitalizations (PCSCH) was prepared, distributed in 19 groups of causes[2], with infectious gastroenteritis and its complications, bacterial pneumonia, and asthma as the three main reasons for hospitalization in children under the age of 1[3].

Studies carried out using secondary data have pointed to the expanded Family Health Strategy (ESF) on the reduction of PCSCH in Brazil[4-6]. However, investigations on PCSCH in children under the age of 5 conducted in different federative units have shown contradictory results. Pernambuco[7] and Piauí[8] states showed a reduction in preventable hospitalizations, while an increase in these events was observed in Paraná[9] state.

Studies that analyze the time trend of PCSCH in children under the age of 1 are still scarce in Brazil, especially in its neonatal and postneonatal components. In the case of child mortality, there is already well-established evidence that the trend of these rates in the past decades is markedly different in the two components, with a slow reduction in neonatal mortality, directly associated with factors related to direct pregnancy, childbirth and puerperium care, and a faster reduction in postneonatal mortality, which is closely related to the social determinants of health[10].

This study aimed to analyze the time trend of PCSCH in children under the age of 1, considering the neonatal and postneonatal age subcomponents in Brazil. In this sense, we expect to contribute to understanding the illness profile of this population based on hospitalization indicators, since the existence of specific determinants for each age component may imply different trends.

Methods

This is a time trend study covering the 2000-2015 period, considering all Brazilian municipalities. The data sources were the Hospital Information System (SIH) and the Live Birth Information System (SINASC), managed by the Informatics Department of the Unified Health System (DATASUS), linked to the Ministry of Health.

In this study, all HAs (Hospitalization Authorizations) related to hospitalization records of children under the age of 1 in public, private, or nonprofit hospitals that provided services to the Unified Health System were included. The set of PCSCH causes was based on the 19 disease groups published in Ordinance N° 221, of April 17, 2008, which defined the Brazilian List of Primary Care-Sensitive Conditions[11].

The PCSCH rates in children under the age of 1 and their age subcomponents were calculated, as were hospitalization rates by the main groups of specific causes: infectious gastroenteritis, bacterial pneumonia, lung diseases, asthma, kidney, and urinary tract infection. Besides these five leading causes, observed in children under the age of 1 and in the postneonatal group, rates of hospitalization due to congenital syphilis in newborns were also calculated, as this was the leading admission cause in this age group. As this is a study with a child population, and given that congenital syphilis represents 91.2% of all hospitalizations in the group "Prenatal care and childbirth-related diseases", we opted to call this group "Congenital syphilis and others congenital infections".

The total number of hospitalizations for children under the age of 1 and their age subcomponents was used as a numerator and the number of live births (LB) as the numerator to calculate hospitalization rates in each year. Hospitalizations in children under the age of 1 were considered as those that occurred in babies under 364 days of life. The age subcomponents were divided into the neonatal period, which corresponded to hospitalizations whose babies were up to 27 days old, and postneonatal period, from 28 to 364 days.

Time trends in the rates of hospitalization due to preventable (general and specific) causes in children under the age of 1 and their age subcomponents were estimated. In the time trend analysis, the Prais-Winsten[12] generalized linear analysis model was used, considering the hospitalization rates as the outcome variable (Y) and time-series' years as the exposure variable (X). The Durbin-Watson Test[13] assessed the adequacy of the Prais-Winsten model.

The use of the Prais-Winsten model built on the method developed by Antunes and Waldman[14-16], who proposed the logarithmic transformation of hospitalization rates, which become the outcome used in the regression model. Then, the regression coefficients ($\beta 1$) and their respective 95% confidence intervals (95%CI), estimated by the model, are transformed into an Annual Percent Change (APC) indicator[15]. From the cal-

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culation of the APC and their respective confidence intervals, we could classify the behavior of the rates into "increase", "decrease", and "stable".

Results

In Brazil, 3,138,540 hospitalizations due to PHC-sensitive conditions were registered in children under 1 year of age from 2000 to 2015, with an annual percentage decrease of 7.4% (95%CI: -10.9; -3.8), and PCSCH rate variation from 72.7/1,000 LB to 48.14/1,000 LB (Graph 1). In the group of newborns, the PCSCH rates showed an annual percentage increase of 6.4% (95%CI: 3.1; 9.7), jumping from 4.36/1,000 LB to 7.40/1,000 LB. In the post-newborns, an annual percentage decrease of 8.9% (95%CI: -12.5; -5.2) was observed in these rates, declining from 68.41/1,000 LB to 40.74/1,000 LB (Graph 2).

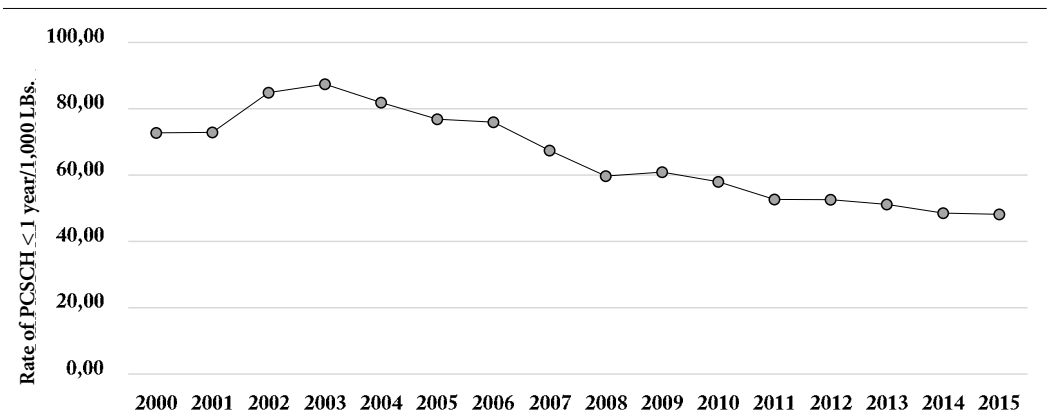
Of the total number of hospitalizations, infectious gastroenteritis (39.2%) was the leading cause for the group of children under the age of 1. Regarding the neonatal and postneonatal components, differences were observed regarding the most frequent causes in each group, where congenital syphilis and the other congenital infections group was responsible for the highest proportion of hospitalizations in newborns (29.5%). In comparison, gastroenteritis prevailed in the group of children in the postneonatal period (41.1%) (Table 1).

Concerning groups of specific PCSCH causes in children in the neonatal period, the rates of hospitalization due to congenital syphilis and other congenital infections showed an annual percentage increase of 24.8% (95%CI: 11.0 - 38.5), the highest increase in this age group. Besides this group, an increase in hospitalization rates for lung diseases and kidney and urinary tract infections was also recorded. The rates of hospitalizations due to bacterial pneumonia were stable, with a reduction of 16% (95%CI: -18.8; -13.0) in the rates of hospitalizations due to gastroenteritis (Table 2).

The analysis of the trend of PCSCH in children in the postneonatal period showed a reduction of 22.6% (95%CI: - 25.6; -19.5) in hospitalization rates for gastroenteritis, and a decrease, to a lesser extent, in the rates of hospitalization due to asthma. Also, in this age group, it worth highlighting an increase in the rates of hospitalizations due to lung diseases and kidney and urinary tract infections and a stable pattern in the bacterial pneumonia rates (Table 3).

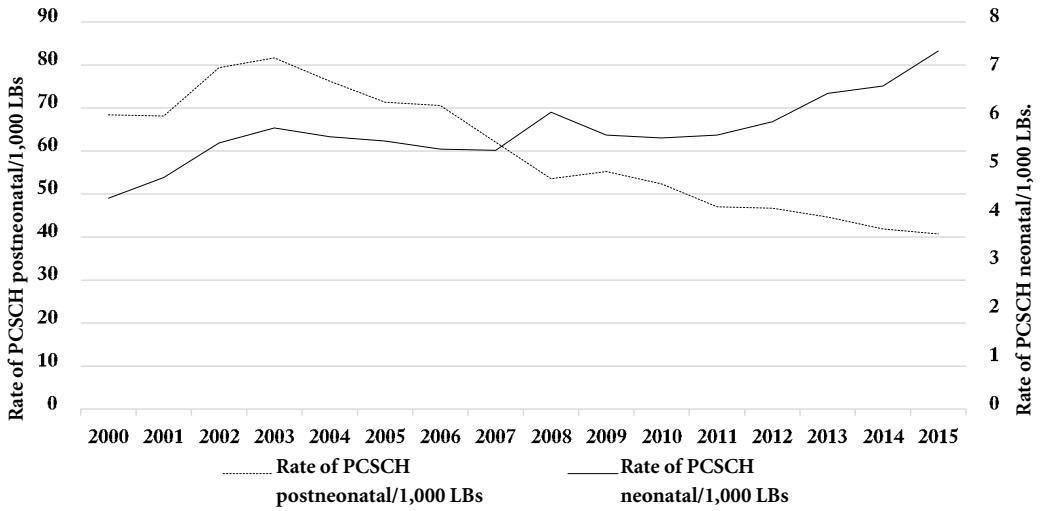
Discussion

The results of this study showed a decrease in the rates of PHC-preventable hospitalizations of children under the age of 1, with profiles of different causes and time trends in the neonatal and postneonatal groups in Brazil. An increasing



Graph 1. Rates of hospitalizations for primary care-sensitive conditions in children under the age of 1, Brazil, 2000-2015.

Source: SIH and SINASC (2016).



Graph 2. Rates of hospitalizations for primary care-sensitive conditions in newborns and post-newborns, Brazil, 2000-2015.

Source: SIH/SUS and SINASC/SUS (2016).

Table 1. Classification of the leading causes of hospitalizations for primary care-sensitive conditions in newborns, post-newborns, and children under the age of 1, Brazil, 2000-2015.

Age group	Groups of causes	Total hospitalizations	Proportion of hospitalizations
Newborn (0-27 days)	1º Congenital syphilis and other congenital infections	80,488	29.5%
	2º Infectious gastroenteritis	52,300	19.2%
	3º Bacterial pneumonia	31,432	11.5%
	4º Lung diseases	29,930	11.0%
	5º Kidney and urinary tract infection	17,868	6.6%
	All PCSCHs	272,443	-
Post-newborn (28-364 days)	1º Infectious gastroenteritis	1,176,965	41.1%
	2º Bacterial pneumonia	479,596	16.7%
	3º Lung diseases	467,336	16.3%
	4º Asthma	361,962	12.6%
	5º Kidney and urinary tract infection	114,875	4.0%
	All PCSCHs	2,866,097	-
< 1 year	1º Infectious gastroenteritis	1,229,265	39.2%
	2º Bacterial pneumonia	510,938	16.3%
	3º Lung diseases	497,266	15.8%
	4º Asthma	373,576	11.9%
	5º Kidney and urinary tract infection	132,743	4.2%
	All PCSCHs	3,138,540	-

Source: SIH/SUS (2016).

Table 2. Trend of hospitalization rates in newborns (per 1,000 live births), per the leading group of primary care-sensitive conditions, Brazil, 2000-2015.

Year	Congenital syphilis and other congenital infections	Lung diseases	Gastroenteritis	Kidney and urinary tract infection	Bacterial pneumonia
2000	0.78	0.43	1.46	0.18	0.30
2001	1.23	0.45	1.58	0.21	0.24
2002	1.14	0.45	1.69	0.27	0.76
2003	1.45	0.46	1.55	0.28	1.00
2004	1.46	0.53	1.32	0.26	1.00
2005	1.48	0.50	1.28	0.30	0.91
2006	1.52	0.51	1.17	0.30	0.91
2007	1.42	0.60	1.03	0.35	0.89
2008	1.30	0.74	1.21	0.49	0.76
2009	1.26	0.70	0.96	0.54	0.76
2010	1.44	0.67	0.92	0.51	0.63
2011	1.66	0.80	0.77	0.48	0.55
2012	1.96	0.79	0.76	0.48	0.47
2013	2.47	0.85	0.71	0.47	0.55
2014	3.03	0.75	0.57	0.47	0.41
2015	3.69	0.91	0.49	0.48	0.42
APC	24.0%	12.6%	-16.0%	16.5%	1.9%
(95%CI)	(11.0 – 38.5)	(10.1 – 15.1)	(-18.8 – -13.0)	(7.9 – 25.7)	(-16.7 – 24.7)
Trend	Increase	Increase	Decrease	Increase	Stable

APC: Annual Percent Change
Source: Hospital Information System - SIH/SUS.

Table 3. Trend in hospitalization rates in children in the postneonatal period (per 1,000 live births), as per the leading group of primary care-sensitive conditions, Brazil, 2000-2015.

Year	Gastroenteritis	Bacterial pneumonia	Lung diseases	Asthma	Kidney and urinary tract infection
2000	40.11	3.54	7.47	10.18	1.30
2001	40.40	3.04	7.65	9.93	1.52
2002	39.94	13.85	7.02	11.42	1.76
2003	37.59	17.53	7.09	11.37	1.88
2004	34.02	16.24	7.72	10.64	1.89
2005	32.89	14.04	7.59	9.09	2.15
2006	30.76	14.94	8.42	8.98	2.19
2007	21.63	14.43	9.57	9.22	2.29
2008	20.63	9.45	9.64	6.62	2.30
2009	19.18	10.45	10.84	6.64	2.99
2010	18.78	8.85	10.89	5.83	2.96
2011	13.23	7.82	12.63	5.26	2.87
2012	12.99	7.00	13.05	4.67	3.09
2013	10.46	7.26	13.52	4.22	3.15
2014	10.14	6.49	12.03	3.40	3.22
2015	8.37	6.67	13.07	3.33	3.40
APC	-22.6%	3.6%	10.9%	-17.0%	14.9%
(95%CI)	(-25.6 – -19.5)	(-17.9 – 30.6)	(7.5 – 14.4)	(-21.6 – -12.1)	(12.1 – 17.8)
Trend	Decrease	Stable	Increase	Decrease	Increase

APC: Annual Percent Change
Source: Hospital Information System - SIH/SUS

trend in PCSCH rates was observed in newborns, and congenital syphilis was the leading cause. In the postneonatal component, a declining trend was observed in hospitalization rates due to sensitive conditions, with infectious gastroenteritis as the cause with the highest magnitude. Different behaviors were identified within each age component in the analysis of the specific causes of preventable hospitalizations, with the coexistence of groups of causes with a decreasing trend, while others increased or remained stable. Moreover, it should be noted that, despite the downward trend, PCSCH rates in children under the age of 1 are still high, revealing the magnitude of this problem.

The decreasing trend of PCSCH rates in children under the age of 1, especially in the postneonatal period, was due to the decline in gastroenteritis-related hospitalizations, which were the causes with the highest magnitude in this age group. Thus, it is plausible to think that actions on the determinants of hospitalizations due to gastroenteritis significantly impacted preventable hospitalizations in the postneonatal period. Furthermore, this age group represents most of the hospitalizations in children under the age of 1, so their behavior reflects what is expected in analyses in child populations. Thus, we can consider that lower hospitalization rates due to gastroenteritis, especially in the neonatal period, given its magnitude, strongly influenced the behavior of PCSCH rates in children under the age of 1.

Some studies have shown declining trends of PCSCH rates in the Brazilian population[4,6], but concerning children, we found only one study addressing the trend of hospitalization in the entire national territory, whose analysis considered the 1999-2006 period[3], and showed results similar to those described in this research.

In the international literature, studies indicate that hospitalizations due to preventable causes in children are associated with a set of socioeconomic determinants, with higher rates of this indicator observed in highly-vulnerable areas[17,18]. Other studies on this theme have shown that lower levels of these preventable hospitalizations can be attributed to the improvement of social determinants of health and the increased access to PHC services[19], which, in Brazil, is reflected in the expanded Family Health Strategy (ESF)[20]. The increased coverage of these services has curbed the levels of hospitalization due to sensitive conditions in children under the age of 5[21] and contributed to the reduction of other adverse outcomes, such as child mortality, which has been attributed to the expanded coverage of immunization actions, the number of prenatal care and childcare visits and collective health actions in areas covered by family health teams[22].

Investigations on neonatal PCSCH are still incipient in the scientific literature. Most studies that analyzed this age group investigated admissions to ICUs or the mortality of these newborns, which hinder comparisons with the findings of this research. The upward trend in PCSCH rates in this age group in Brazil can be attributed to several factors. The expanded services of the Unified Health System (SUS) may have increased access to hospital care, meeting a demand for services of greater complexity in previously unassisted places. However, it is also necessary to consider that prenatal care and delivery problems may have influenced the illness of these newborns, exposing them to a higher risk of hospitalization after delivery and in the first days of life[23,24].

Another important finding of this study was the trend of increasing rates of hospitalizations due to prenatal care-related and childbirth-related diseases in the group of children in the neonatal period. The main cause of this group of diseases is congenital syphilis, morbidity, whose incidence has increased to the point of being considered an epidemic in Brazil. This epidemic has been attributed to increasing syphilis cases in the adult population, especially in women, due to the vertical transmission of the disease, related to prenatal care problems in mothers diagnosed with syphilis. Structural and organizational problems that compromise the quality of these actions in the country[25,26] persist despite expanded PHC services, and increased coverage of prenatal visits.

The discussion on PCSCH in neonates still needs to ponder on issues that concern the avoidability of hospitalization in this group, considering which causes do not require hospitalization and those whose hospitalization is desirable. However, they are present in the Brazilian List of Preventable Conditions. In the latter cases, where hospitalization is thought to be desirable, given the difficulty of managing it on an outpatient basis, the increase in hospitalizations may reveal the expanded access to hospital services, with a potential effect in reducing mortality.

A study that evaluated the effect of ESF on children's hospitalizations due to pneumonia[27], a disease whose clinical management indicates hospitalization as the best treatment option for newborns up to two months of age[28], concluded that the expanded coverage of the Family Health

Strategy was associated with the increase in hospitalizations for pneumonia in these newborns. These findings showed that higher PCSCH rates in this age group had positive effects since the health system was able to identify the needs of this population at the most basic level and refer them to higher complexity services[27].

Moreover, the problems inherent in the use of secondary data from the Hospital Information System stand out as a limitation of the study, such as diagnostic errors in filling in the underlying cause of hospitalization in the Hospitalization Authorizations (HA). Despite these limitations, we should highlight the advances in improving this system and in the diagnostic reliability of HAs for the classification of hospitalizations as PHC-sensitive conditions. It also points out the usefulness of secondary, open-access data to carry out national epidemiological time-trend studies without having to provide a substantial financial and logistical contribution for its implementation[29,30].

Another point to be highlighted is the uniqueness of the Brazilian List of preventable causes of hospitalization, and it is essential to adjust its definition in order to have an instrument capable of capturing the specificities of certain age groups. Thus, the creation of specific lists, such as the Brazilian List of Preventable Deaths by Unified Health System Interventions, which considers a group of causes for people aged 0-4 years, and another aged 5-74 years[31] can help in the construction of PCSCH indicators even more useful for health assessment, planning, and management.

This study presented a detailed description of PCSCH in children under the age of 1 in Brazil, highlighting the trends and leading causes in different age groups (newborns and post-newborns). The choice of a descriptive study revealed their potential to show with greater detail the different behaviors of this indicator.

Differences in PCSCH trends in children under the age of 1, which may reflect the influence of specific determinants on the risk of hospitalization in each age subcomponent, and point to the need to study them separately. The compression of the different factors associated with PCSCH in newborns and post-newborns may allow the implementation of specific and effective interventions in each age group to reduce these morbidities and their negative repercussions on the lives of children and their families. In this sense, there is a need for further studies to investigate how social protection programs, such as the *Bolsa Família* (Family Grant), and the expanded to health services, especially within the Family Health Strategy, influence the trends of avoidable hospitalizations in newborns and post-newborns. We also suggest investigating PCSCH trends and profiles in children under the age of 1, by Brazilian state and region, to know the different behaviors of this indicator in the different underlying scenarios in this country.

Collaborations

EP Pinto Junior participated in the conception and design, analysis and interpretation of data, and drafting of the paper. R Aquino participated in the conception and design, data interpretation, and relevant critical review of the paper's intellectual content. I Dourado participated in data interpretation and relevant critical review of the intellectual content of the paper. LQ Costa participated in the conception and project, data interpretation, and drafting of the paper. MGC Silva participated in the conception and design, data interpretation, and relevant critical review of the paper's intellectual content.

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