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Hospitalizations for ambulatory care-sensitive conditions in children, Rondônia, Brazil, 2008-2019

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Abstract *This study aimed to define the profile of hospitalizations of children in public hospitals of 52 municipalities of the state of Rondônia, Brazil. We performed an ecological time series study using secondary data provided by the Hospital Information System. The annual trend of Hospitalizations was presented by age group and health region. Linear regression was performed using the Prais-Winsten technique of the statistical package Stata, version 11.0. Hospitalizations for gastrointestinal diseases were found to be decreasing in all age groups, just as those for vaccine-preventable diseases in children aged between 1 and 9 years. Hospitalizations for skin and subcutaneous tissue diseases were increasing in all ages, as well as those caused by epilepsies in children aged 1 to 9 and those caused by diseases related to childbirth and puerperium. Health regions showed a varied hospitalization profile. A stable trend was found in the Cone Sul, Madeira-Mamoré, Café, Vale do Guaporé, and Vale do Jamari regions, whereas a declining trend was found in the Central and Zona da Mata regions. The high rates of hospitalizations for ambulatory care-sensitive conditions in children show how inefficient strategies and investments in primary care have been in the state of Acre, Brazil.*

Key words *Child health, Hospitalization, Primary health care*

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Introduction

Hospitalizations for ambulatory care-sensitive conditions (ACSC hospitalizations) are indicators that reveal how efficient primary health care (PHC) actions are in practice[1]. In Brazil, these actions are developed by the Public Health System (PHS) and are part of the Family Health Strategy (FHS) to monitor communities and families, including children, that are registered and treated by health centers[2,3].

Specific and timely interventions by PHC may reduce the hospitalization risk in this group by valuing prevention, diagnosis and early treatment of acute diseases. In addition, these actions may help reduce control and monitoring costs of chronic diseases[4,5].

Studies show that morbidity in children is directly related to socio-environmental factors, such as basic sanitation, income, access to health services and the specificities of this stage of life, all of which can often help avoid hospitalizations. Unlike adults, children are more often prone to acute diseases, which could be prevented by PHC services[5,6] .

In this context, it is known that ACSC hospitalizations in childhood increase the socioeconomic and psychological costs of children and their families, as they require a high volume of PHC resources. In addition, new hospitalizations may predispose to other diseases and conditions, requiring investments that could instead be applied in child health care training in PHC[7].

In Brazil, studies on ACSC hospitalizations of Brazilian children gained greater prominence after the Ministry of Health implemented and adapted the Brazilian List of ACSC Hospitalizations, which identifies and classifies different conditions that affect all age groups, i.e., from children to the elderly[8].

Available studies on ACSC hospitalizations of Brazilian children reveal a rather varied profile in the Northeast[6,7], Southeast[9], South[10] and North regions of the country[11]. Gastroenteritis prevailed in the Northern and Northeastern regions, whereas respiratory diseases prevail mostly in the Southern and Southeastern regions. These data show that not only age-related aspects are considered to understand the appearance of diseases, but also climate factors and regional differences, such as access and availability of basic educational and health services[10,12,13].

In Rondônia, according to a study on ACSC hospitalizations conducted from 2012 to 2016, of 133,958 hospitalizations, 24.8% were caused by preventable health issues. Of this percentage, 14.8% were children aged up to 4 years and 9.3% were aged between 5 and 9, a total of 24.1% of all ACSC hospitalizations in this state[11]. However, in addition to a lack of studies on these conditions in children, there is a high rate of preventable early neonatal deaths, which in turn were related to prenatal care, childbirth and immunization[14].

That said, establishing the profile of hospitalizations of children helps to understand these phenomena in the health-disease process of this group to guide actions to prevent diseases in a timely manner and avoid unnecessary hospitalizations[15]. In addition, results may support municipal managers in planning health care policies aimed at that group in the Health Care Network of Rondônia.

The present study aims to establish the profile of ACSC hospitalizations of children in the state of Rondônia that occurred from 2008 to 2019.

Methods

Study type

We performed an ecological time-series study based on secondary hospitalization data (2008-2019) obtained from the Hospital Information System (HIS-SUS) of the IT Department of the Brazilian Public Health System (www.datasus.gov.br).

The choice of the 2008-2019 time series took into account the initial period of the implementation of the ACSC hospitalization list in Brazil in 2008.

Study population

Study population consisted of children residing in the 52 municipalities of Rondônia who were hospitalized from January 1, 2008 to December 31, 2019 and had their Hospital Admission Authorization (AIH) form filled out according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) of 1997 by the World Health Organization and according to the ACSC Hospitalization List[1].

Definition of variables

The age variable was studied by age groups according to HIS data (under 1 year, from 1 to 4 years, and from 5 to 9 years).

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To establish age delimitation, we used the World Health Organization (WHO) and PNAISC concept of child applied to the scope of the Brazilian Public Health System[2]. The definition of Rondônia's health regions followed the Resolution 087 of the Bipartite Intermanagement Commission (BIC) of Rondônia of May 8, 2014, which groups the state's 52 municipalities into seven health regions (Madeira Mamoré, Vale do Jamari, Central, Zona da Mata, Café, Cone Sul, Vale Guaporé)[16,17].

Census data and population estimates of every health region were used as defined by the Brazilian Institute of Geography and Statistics (IBGE) and as available on the website of the IT Department of the Brazilian Public Health System (DATASUS).

Hospitalization causes were analyzed according to the chapters and groupings of the International Statistical Classification of Diseases and Related Health Problems (Tenth Revision, ICD-10)[1] and the List of Hospitalizations for Ambulatory Care-Sensitive Conditions (ACSC hospitalizations)[8], as described in Chart 1.

Organization and statistical analysis of data

HIS Data were collected, entered into MS Excel spreadsheets and analyzed by means of the STATA software program, version 11.0 (College Station, Texas, USA). Annual hospitalization rates were calculated for the period evaluated by age group and health region. Cause-proportional morbidity rates were calculated using the total number of hospitalizations by type in every specific year, divided by the total population of interest in the same area and year and multiplied by 10,000.

Annual trend analysis of hospitalizations was performed by means of a linear regression using the Prais-Winsten technique, after the serial autocorrelation had been checked using the Durbin and Watson test. Trends were classified as decreasing, stable and increasing.

Theoretical foundation was developed by means of the Latin American and Caribbean Health Sciences Literature (LILACS) and Scientific Electronic Library Online (SciELO) published in Portuguese, which provided full texts indexed by the following descriptors: hospitalization, child, preventable causes.

Ethical aspects

The present study is part of a larger research project entitled "Study on morbidities in Rondônia", approved under CAAE – 46586315.9.0000.5300 by the Research Ethics Committee of the UNIR according to the guidelines of Resolution 466/CNS/2012 of the National Health Council[18].

Results

From 2008 to 2019, the annual ACSC hospitalization trend in children in the state of Rondônia varied among age groups and ACSC hospitalization groups.

Table 1 shows that the trend of ACSC hospitalizations caused by infectious gastroenteritis and complications decreased in the three age groups (< 1 year: -8.62%; 1 to 4 years: -7.25%; 5 to 9 years: -4.95%). On the other hand, skin and subcutaneous tissue infections showed an increasing annual trend in all age groups (14.32%; 17.87%; 18.18%).

In children, ACSC hospitalizations caused by respiratory diseases showed a stable trend in all age groups (< 1 year: -1.24%; 1-4 years: 0.32%; 5-9 years: 1.75%), just as hospitalizations caused by kidney and urinary tract infections (-1.15%; -1.49%; 0.01%).

ACSC hospitalizations due to immunization-preventable diseases/sensitive conditions showed a stable trend in two age groups (< 1 year: -2.60%; 5-9 years: -3.76%) and a declining trend in children aged 1 to 4 (-8.51%). The group defined as "others" also showed a stable trend in two age groups (1-4 years: -3.44%; 5-9 years: -1.64%), but an increasing trend in children under one year (2,75%).

The annual trend of ACSC hospitalizations caused by epilepsies increased in the age groups of 1-4 years (12.05%) and 5-9 years (12.17%). Regarding children under one year, diseases related to prenatal care and childbirth also showed an increasing annual trend (24.20%).

Considering the regions of the state of Rondônia, Table 2 shows that the annual trend of ACSC hospitalizations varied in all the three age groups. Regions with a stable trend included Vale do Guaporé (-3.92%), Cone Sul (-1.68%), Vale do Jamari (-0.95%), Café (2.10%), and Madeira-Mamoré (2.73%). A declining trend was found in the Central (5.66%) and Zona da Mata (-3.97%) regions.

Chart 1. List of ambulatory care-sensitive condition groups and List of International Classification of Diseases – ICD-10.

ACSC group	ICD-10 code
1.Immunization-preventable diseases and sensitive conditions	A33-A37, A95, B16, B05-B06, B26, G00.0, A17.0, A19, A15-A16, A18, A17.1-A17.9, I00-102, A51-A53, B50-B54 and B77
2. Infectious gastroenteritis and complications	E86 and A00-A09
3. Anemia	D50
4. Nutritional deficiencies	E40-E46 and E50-E64
5. Ear, nose and throat infections	H66, J00-J03, J06 and J31
6. Bacterial pneumonias	J13-J14, J15.3-J15.4, J15.8-J15.9 and J18.1
7. Asthma	J45-J46
8. Lower airway diseases	J20, J21, J40-J44 and J47
9. Hypertension	I10-I11
10. Angina	I20
11. Heart failure	I50 and J81
12. Cerebrovascular diseases	I63-I67, I69 and G45-G46
13. Diabetes mellitus	E10-E14
14. Epilepsies	G40-G41
15. Kidney and urinary tract infection	N10-N12, N30, N34 and N39.0
16. Infection of the skin and subcutaneous tissue	A46, L01-L04 and L08
17. Inflammatory disease of female pelvic organs	N70-N73 and N75-N76
18. Gastrointestinal ulcer	K25-K28, K92.0, K92.1 and K92.2
19. Diseases related to prenatal care and childbirth	O23, A50 and P35.0

Source: Brazilian Ministry of Health[8].

Discussion

The present study identified high rates of ACSC hospitalizations in children in the state of Rondônia which showed important variations between age groups and condition groups. Its findings corroborate other studies performed in Brazil[19-21] and in European countries, such as Italy. Those countries show a considerable decrease in the rate of ACSC hospitalizations in children[22].

However, it should be noted that hospitalization features vary and are directly associated with several intrinsic regional factors, such as epidemiological conditions and their level of socioeconomic and cultural development[23].

In Brazil, typical regional conditions also impact the health indicators of its population. The Observatory of Children and Adolescents and the Brazilian Institute of Geography and Statistics, IBGE (2017) show that indicators of access to water and sewage network not only reveal Brazil's inequalities in general, but also show greater and more frequent differences in the Northern and Northeastern regions, including the state of Rondônia[24,25]. We also found that in this region, access is not expanded, which means that peripheral municipalities are the most affected ones by the lack of resources required to promote health[11].

However, only 12.2% of the population had access to a sewage system in the state of Rondônia in 2018 and in 2019, this figure decreased to 11.4%. Similarly, 49.4% of the total population had access to the public water distribution system in 2018, which decreased to 46.9% in 2019. This scenario is due to populational increase and the lack of urban planning in the state, to the detriment of the population[24].

The epidemiological scenario in the state of Rondônia is strongly influenced by persistent structural issues, such as its socioeconomic and nutritional precariousness, lack of basic sanitation, among other factors, which results in a high number of ACSC hospitalizations in children. Some age groups even reach similar rates as those of parasitic diseases[11].

Likewise, as corroborated by international literature, hospitalizations for preventable causes in children are directly associated with a variety of socioeconomic factors that contribute to high

Table 1. Annual trend of hospitalizations of children due to ambulatory care-sensitive condition (ACSC hospitalizations), Rondônia, Brazil, 2008-2019.

ACSC Group	Annual trend	(Confidence Interval 95%)	Trend
< 1 year			
1. Immunization-preventable diseases/sensitive conditions	-2.60	-11.36; 7.02	Stable
2. Infectious gastroenteritis and complications	-8.62	-9.84; -7.38	Decreasing
4. Nutritional deficiencies	-0.32	-5.58; 4.58	Stable
8. Respiratory diseases	-1.24	-3.75; 1.34	Stable
15. Kidney and urinary tract infection	-1.15	-3.71; 1.48	Stable
16. Infection of the skin and subcutaneous tissue	14.32	8.66; 20.28	Increasing
19. Diseases related to prenatal care and childbirth	24.20	19.69; 28.88	Increasing
Others[1]	2.75	1.36; 4.16	Increasing
1 to 4 years of age			
1. Immunization-preventable diseases/sensitive conditions	-8.51	-13.94; -2.74	Decreasing
2. Infectious gastroenteritis and complications	-7.25	-9.28; -5.17	Decreasing
8. Respiratory diseases	-0.32	-5.00; 4.58	Stable
14. Epilepsies	12.05	-6.07; 18.36	Increasing
15. Kidney and urinary tract infection	-1.49	-0.89; 3.94	Stable
16. Infection of the skin and subcutaneous tissue	17.87	-7.34; 29.42	Increasing
Others[2]	-3.44	-6.79; 0.03	Stable
5 to 9 years of age			
1. Immunization-preventable diseases/sensitive conditions	-3.76	-10.83; 3.87	Stable
2. Infectious gastroenteritis and complications	-4.95	-7.77; -2.06	Decreasing
8. Respiratory diseases	1.75	-0.22; 3.77	Stable
14. Epilepsies	12.17	7.03; 17.56	Increasing
15. Kidney and urinary tract infection	0.01	-2.74; 2.85	Stable
16. Infection of the skin and subcutaneous tissue	18.18	9.57; 27.48	Increasing
Others[3]	-1.64	-3.41; 0.15	Stable

Others[1]: groups 3, 9, 10, 11, 12, 13, 14, 17 and 18 of ICD-10. Others[2]: groups 3, 4, 9, 10, 11, 12, 13, 14, 17, 18 and 19 of ICD-10. Others[3]: groups 3, 4, 9, 10, 11, 12, 13, 14, 17, 18 and 19 of ICD-10.

Source: Hospital Information System (IT Department of the Public Health System, http://www.datasus.gov.br).

Table 2. Annual trend of hospitalizations of children due to ambulatory care - sensitive conditions (ACSC hospitalizations) per health regions, Rondônia, Brazil, 2008-2019.

Health regions	Annual trend	(Confidence Interval 95%)	Trend
1. Madeira-Mamoré	2.73	-0.26; 5.81	Stable
2. Vale do Jamari	-0.95	-4.78; 7.05	Stable
3. Central	-5.66	-7.84; -3.43	Decreasing
4. Zona da Mata	-3.97	-5.96; -1.93	Decreasing
5. Café	2.10	-3.54; 8.08	Stable
6. Cone Sul	-1.68	-3.93; 0.61	Stable
7. Vale do Guaporé	-3.92	-10.59; 3.23	Stable

Source: Hospital Information System (IT Department of the Public Health System, http://www.datasus.gov.br).

rates of hospital admissions in areas of greater vulnerability, as shown by the context of the present study[26].

The state of Rondônia shows a comparable scenario, since the monthly household income of the resident population in 2020 lay below the national average[25], according to IBGE (2020). Thus, ACSC hospitalizations of children for skin and subcutaneous tissue infections showed the highest annual trend in the 1-4 and 5-9 age groups,

as well as an increasing trend in all age ranges, which may be due to unfavorable socioeconomic conditions to health.

Although infectious gastroenteritis showed a declining trend in all age groups, it remains the main cause of ACSC hospitalizations in children aged 1-4 and 5-9 years. On the other hand, in children under one year, infectious gastroenteritis was the second leading cause of hospitalizations, a finding that differs from other studies conducted in other Brazilian states, according to which this cause was also predominant in children under one year[7].

A study performed in the state of Ceará found that of 388,973 records of ACSC hospitalizations of children under 5 years of age that took place from 2000 to 2012, the highest rates of hospitalizations occurred in children under one year and the post-neonatal component was the main hospitalization cause. Therefore, the high rates of ACSC hospitalizations in children under one year may be related to the developmental stage in which the body's immune system is still in the process of formation and/or maturing[27].

In the present research, diseases related to prenatal care and childbirth showed a higher and increasing annual trend in children under one year, just as ACSC hospitalizations caused by skin and subcutaneous tissue infections and the group identified as others. ACSC hospitalizations caused by diseases related to prenatal care and childbirth may have an impact on the increasing trend of ACSC hospitalizations caused by epilepsies in the 5-9 age group and on the partially stable trend in the 1-4 age group, since in children, ACSC hospitalizations may be associated with issues that occur during prenatal care and result from the neonatal phase[27]. This assessment is corroborated by national[28] and international[29] studies which state that children under 5 years are more vulnerable to ACSC hospitalizations at this stage of life.

Research in Brazil's northern region, i.e., the setting of this study, shows that respiratory diseases, especially asthma and pneumonia, showed the highest rate of ACSC hospitalizations in children under 5 years, which reveals how inefficient early diagnosis and treatment of those diseases in Primary Care are. It also reveals the lack of territorial searches for socio-environmental factors that favor their emergence and worsening that currently takes place[6,12,30].

It is noteworthy that in children under one year, ACSC hospitalizations caused by diseases that can be prevented by immunization/sensitive conditions, in addition to nutritional deficiencies and infections of the kidney and urinary tract, showed a persistently stable trend throughout all the years we analyzed. These findings may be related to the increased coverage of actions such as systematic vaccination of children and the intensification of educational health activities aimed at childcare in the context of PHC[31].

In the present study, ACSC hospitalizations in children by health regions of the state of Rondônia maintained a stable trend in the Madeira-Mamoré and Café regions. According to a report by the State Health Department[17] , both regions have a strong impact on the general rate of ACSC hospitalizations in the state, as they are populous municipalities and run the greatest number of hospital infrastructures, which corroborates studies conducted in other states[32]. Thus, partnerships between different health areas result in stability in populous regions.

The present study allows us to conclude that the profile of ACSC hospitalizations of children in Rondônia varies among age groups and condition groups. As can be seen, some of the preventable diseases in PHC, such as skin and subcutaneous tissue infections, tend to increase in all age groups, which reveals a large scenario of unnecessary hospitalizations, as well as the neglect of healthcare managements. This scenario exposes serious failures in child healthcare of PHC, since it shows serious restrictions in the reception and early identification of health issues that mainly affect children up to one year.

These findings highlight the fact that municipal health management actions and strategies urgently need to be (re)planned, especially regarding investments in service infrastructure and training of health professionals so that children and their families may be assisted in time to avoid health complications that could be fully addressed by primary care.

Limitations of the present study are due to incomplete admission forms, especially regarding the fields on patients' gender and residential address, since admissions are manually quantified in physical forms and later entered in a digital system, which is prone to produce mistakes, since several people take part in the process. In addition, the ecological bias corroborates a limitation of the specificities of every health center of the public health network. However, those limitations do not invalidate our findings, as the sample analyzed during the study period is considerably large.

Conclusion

In Rondônia, ACSC hospitalizations of children that took place between 2008 and 2019 were associated with intrinsic and extrinsic factors of primary care actions.

Most hospitalizations were caused by either skin infections or gastroenteritis, which shows to what extent common clinical symptoms, such as diarrhea and colic, are neglected and which also reveals gaps and serious flaws in care and guidance aimed at the full growth and development of children.

The trends of stable and declining ACSC hospitalization rates in the state of Rondônia reflect the national trends, but show a higher number of hospitalizations, which raises concern over social and health determinants that are getting worse and impact the child health-disease process.

Health service managers and professionals should urgently review child health surveillance strategies at different care levels, especially Family Health Strategy teams in the field of Primary Health Care of every municipality, by considering local peculiarities.

Collaborations

JLG Freitas conceived the study idea and design, data analysis and interpretation, manuscript writing, final approval of the manuscript and was in charge of it in its entirety. PPS Pereira participated in the organization of the database and data analysis, manuscript writing and review and its final approval. DFB Cavalcante contributed to the study design, data analysis and interpretation, manuscript writing and its final approval. AS Santos, LR Castro, JC Alves and TMC Oliveira contributed substantially to data organization, analysis and interpretation, as well as to manuscript writing and review.

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