

# Hospitalizations for respiratory diseases in childhood in Brazil and Guinea-Bissau: an integrative review

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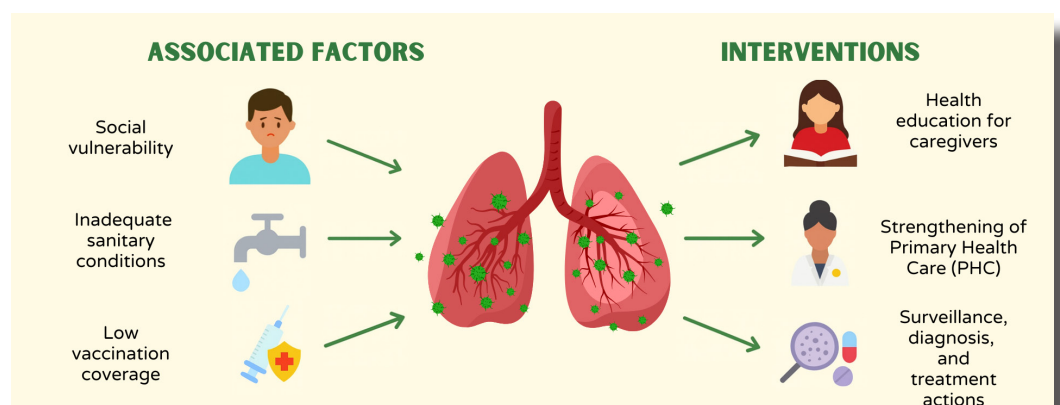
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## Highlights

- Pneumonia is the leading cause of pediatric respiratory hospitalization in Brazil.
- Low vaccination coverage and limited access to Primary Health Care (PHC) contribute to increased childhood hospitalizations.
- Health education can reduce hospitalizations due to preventable respiratory conditions.

## Graphical Abstract



## Abstract

Primary health care practices in child health, such as nutrition, immunization, care for prevalent diseases, prenatal care, and family planning, are determinants of childhood morbidity. This study aimed to identify evidence related to hospital admissions for respiratory diseases in children in Brazil and Guinea-Bissau. This is an integrative review study, with data collection conducted from July to October 2023 in the LILACS, PubMed, and SciELO databases. A total of 840 articles were identified, of which 30 were selected for evidence analysis. There was a predominance of articles from the field of Medicine, published between 2015 and 2022, all from Brazil, with a higher prevalence of level 4 evidence. The main determinants associated with pediatric respiratory hospitalizations were related to sanitary conditions, socioeconomic vulnerability, low educational attainment of caregivers, distance from health services, low adherence to immunization, and exposure to air pollution. It is concluded that hospital admissions for respiratory diseases are, for the most part, influenced by controllable factors intrinsically associated with access to health services. In-service education for professionals, improvements in access, and early identification of respiratory conditions, in addition to health education for family members and caregivers, may contribute to reducing hospitalizations.

**Keywords:** Child Health. Respiratory Diseases. Hospitalization. Pediatric Nursing.

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## INTRODUCTION

Hospital admissions for respiratory diseases affect thousands of children worldwide and are influenced by environmental and socioeconomic conditions; low maternal educational attainment and unwanted pregnancy also negatively affect child health. Depending on the complexity and severity of the disease, families experience considerable distress, and hospitalization-related burdens may arise. These can be mitigated through child treatment and the prevention of complications of chronic conditions, thereby avoiding unnecessary hospitalizations<sup>1</sup>.

Currently, child health is one of the priorities of Brazil's Ministry of Health (MH), and several public policies and programs have been created with the aim of promoting health, preventing disease, and reducing hospitalizations due to preventable conditions, as well as reducing Infant Mortality (IM) indicators. Through strategies such as comprehensive follow-up during the first two years of life, postpartum consultations, humanization of care, and encouragement of breastfeeding, the infant mortality rate was significantly reduced between the 1980s and 1990s – a period during which child health came to be highlighted through the programs developed<sup>1</sup>.

In the 1990s, the leading cause of hospital admissions in children across all states of Brazil was respiratory system diseases<sup>2</sup>. Based on this context, the Primary Health Care (PHC) program was structured, focusing on actions aimed at preventing hospitalizations, which subsequently resulted in the consolidation of the concept of "Hospitalizations for Primary Care-Sensitive Conditions" (HPCSC), used as an indicator of access and quality of health services in Brazil.

In 2016, a study addressing the main causes of hospitalization in children under five years of age in Brazil, with a particular focus on the state of Rio Grande do Sul (RS), revealed that respiratory system diseases were the most common, particularly asthma, which stood out as the leading cause of hospitaliza-

tion<sup>3</sup>.

In Guinea-Bissau, the health status of children is poorly documented due to the absence of a data reporting system, which makes it difficult to characterize the health of the population. However, data from the United Nations Children's Fund (UNICEF) indicate that the country has one of the highest mortality rates in the world, with a child mortality rate of 51 per 1,000 live births dying before the age of five, and 22 per 1,000 live births dying during the first 28 days of life<sup>4</sup>.

According to the UNICEF 2024 report, 94% of children under five years of age registered by Community Health Workers (CHWs) in Guinea-Bissau received treatment for prevalent childhood diseases such as malaria, diarrhea, and pneumonia, were vaccinated, and underwent nutritional assessments. In 2023, CHWs visited 113,218 children under five years of age; these and other factors contributed to the reduction of high hospital admission rates and early deaths in that country<sup>4</sup>.

The World Health Organization (WHO), in partnership with Brazilian states, developed several strategies to reduce hospitalizations, including the training of professionals working in the Family Health Strategy (FHS) to reduce admissions due to preventable causes, as well as the expansion of home visits to low-income families, mothers with low educational attainment, and children born with low birth weight, for example<sup>2</sup>.

Given the above, it is relevant to identify the main evidence related to the causes of hospital admissions for respiratory diseases in children. Thus, the following question is posed: what evidence is available regarding the factors associated with such hospitalizations in Brazil and Guinea-Bissau? From this basis, the present study aimed to identify evidence related to hospital admissions for respiratory diseases in children in Brazil and Guinea-Bissau.

## METHOD

This is an integrative literature review study, which allows the synthesis and integration of evidence and concepts present in the scientific literature on the investigated topic<sup>5</sup>. The review protocol was constructed through the following steps: formulation of the review question, retrieval of information from databases, critical appraisal and interpretation of the information obtained, organization of findings into thematic categories, and, finally, presentation of results and elaboration of conclusions.

To this end, the PICo acronym was used to formu-

late the research question and organize data collection.

Scientific evidence was classified into seven hierarchical levels according to methodological rigor: level 1 – systematic reviews or meta-analyses of randomized clinical trials, as well as clinical guidelines based on this type of review; level 2 – results from at least one randomized controlled clinical trial; level 3 – well-designed clinical trials without randomization; level 4 – observational cohort or case-control studies with appropriate design; level 5 – systematic reviews

of descriptive or qualitative research; level 6 – evidence from a single descriptive or qualitative study; level 7 – expert opinions or reports prepared by reference committees<sup>6</sup>.

Data were collected between June and October 2023 in the Latin American and Caribbean Health Sciences Literature (LILACS), National Library of Medicine (PubMed), and Scientific Electronic Library On-

line (SciELO) platforms. The following descriptors were used: *crianças*, child, *niño*, “doenças respiratórias”, “respiratory tract diseases”, “enfermedades respiratorias”, *hospitalização*, hospitalization, *hospitalización*; in Portuguese, English, and Spanish, combined with the Boolean operators “OR” and “AND”. The search strategies employed are presented in Table 1, showing the crossover of descriptors across databases.

**Table 1** - Search strategy in databases. Santa Maria, RS, Brazil, 2024.

Database	Search Strategy
LILACS	<i>crianças</i> OR child OR <i>niño</i> AND "doenças respiratórias" OR "respiratory tract diseases" OR "enfermedades respiratorias" AND <i>hospitalização</i> OR hospitalization OR <i>hospitalización</i> AND fulltext:("1" OR "1" OR "1") AND db:("LILACS:[2015 TO 2022])
PubMed	child AND "respiratory tract diseases" AND hospitalization. Filters: Free full text, from 2015–2022
SciELO	("child") AND ("international")

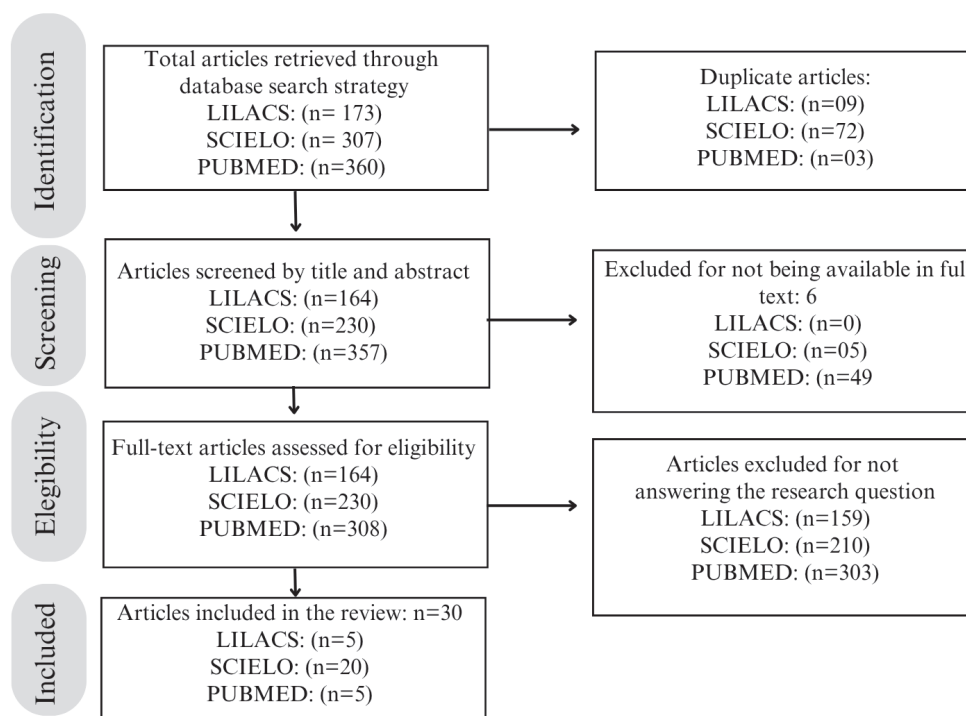
Inclusion criteria comprised primary articles on the proposed topic that answered the review question, written in Portuguese, English, or Spanish, with Brazil and Guinea-Bissau as the study setting. The temporal scope was delimited to 2015–2022, given that 2015

marked the year in which Brazil’s Ministry of Health published the National Policy for Comprehensive Child Health Care – a landmark for child health<sup>7</sup>. Articles not available in full text, duplicates, and those that did not answer the study question were excluded.

## RESULTS

The initial search strategy identified a total of 840 articles – 173 in LILACS, 360 in PubMed, and 307 in SciELO – of which 30 were included in the study cor-

pus. Figure 1 presents the search and selection flowchart for this integrative review, based on the PRISMA model<sup>8</sup>.



**Figure 1** - Flowchart of the article search and selection process. Santa Maria, RS, Brazil, 2024.

Data were organized and interpreted through the systematic construction of an analytical synopsis table, Figure 2. The figure contains the following information: study code, authors, year/country, title, methodological design, results, and conclusions.

CODE	AUTHORS COUNTRY/YEAR	TITLE	METHODOLOGICAL DESIGN	RESULTS	CONCLUSIONS	EVIDENCE LEVEL
A-1	Jacomim, Shibukawa e Higarashi. Brasil, 2020 <sup>9</sup>	Childhood Hospitalizations for Primary Care-Sensitive Conditions in a Southern Brazilian State	Ecological, descriptive, quantitative approach study	Respiratory diseases were the leading cause of hospitalization among the analyzed children, followed by infectious and parasitic diseases. Perinatal conditions also ranked among the main reasons for pediatric hospitalization.	There is coherence between the reality observed in pediatric clinical practice and the data obtained in the study. Reflection is raised on the effectiveness of prevention and health education actions implemented by primary care.	EL-4
A-2	Machin e Nascimento Brasil, 2017 <sup>10</sup>	Effects of air pollutant exposure on the health of children in Cuiabá, Mato Grosso, Brazil	Ecological, time-series study	A total of 565 hospitalizations were recorded during the analyzed period, corresponding to a daily mean of 1.54. Statistically significant associations were found between particulate matter exposure and hospitalizations during the second semester. A 5 µg/m <sup>3</sup> increase in fine particulate matter concentration was associated with an estimated increase of 89 hospitalizations, resulting in costs exceeding R\$ 95,000 for the Unified Health System (SUS).	In the second semester, a period of lower rainfall, a higher risk of respiratory hospitalizations was observed, reinforcing the need for public policies aimed at reducing atmospheric pollution and preparing health services for increased demand, thereby reducing social impacts and costs to the SUS.	EL-4
A-3	Souza <i>et al.</i> , Brasil, 2018 <sup>11</sup>	Acute lower respiratory tract infection in Guarani indigenous children, Brazil	Cross-sectional study	Among the 211 children evaluated (median age: 11 months), cases of acute lower respiratory tract infection (ALRTI) were classified as viral (40.8%), bacterial (35.1%), and viral-bacterial (24.1%). Approximately 53% of hospitalizations lacked clinical-radiological-laboratory justification. In regression analysis, cough was 3.1 times more frequent in bacterial ALRTI, and tachypnea was 58% less frequent in viral ALRTI compared with viral-bacterial ALRTI.	There was a predominance of viral over bacterial infections, as well as mixed viral-bacterial cases. Cough was associated with bacterial infections, while retractions and tachypnea were indicative of viral-bacterial conditions. A proportion of non-severe ALRTIs was managed in hospital settings, highlighting the need to strengthen primary care and improve indigenous health care.	EL-6
A-4	Moraes <i>et al.</i> , Brasil, 2019 <sup>12</sup>	Meteorological variables and air pollution and their association with respiratory hospitalizations in children: a case study in São Paulo, Brazil	Ecological study	Statistically significant associations were found between higher relative risk of respiratory hospitalizations and the variables: mean air temperature (17.5°C to 21°C), high relative humidity (84% to 98%), low precipitation (0 to 2.3 mm), and high concentrations of particulate matter (> 35 µg/m <sup>3</sup> ).	The highest hospitalization risk occurred at intermediate temperature ranges. Extreme temperatures were not the most critical. Relative humidity, precipitation, and atmospheric pollution proved to be determining environmental factors in the increase of childhood hospitalizations, especially among girls, who showed greater sensitivity to climatic variations.	EL-4
A-5	Silva <i>et al.</i> Brasil, 2021 <sup>13</sup>	Hospitalization for whooping cough in children in the pre- and post-implementation period of the dTpa vaccine for pregnant women	Observational, quantitative ecological study	Between 2007 and 2017, 342,139 respiratory hospitalizations in children under one year of age were recorded, of which 3,062 were for whooping cough. The mean annual rate decreased from 102.2 to 46.8 per 100,000 following vaccine introduction, representing a 54.2% reduction in records, with a peak in 2013 (139/100,000) and a decline to 47.9/100,000 in 2017.	After the introduction of the dTpa vaccine, a reduction in whooping cough hospitalizations was observed, even with vaccination coverage below 50%, indicating that lack of vaccination was no longer as relevant a predictor of hospitalization.	EL-4

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CODE	AUTHORS COUNTRY/YEAR	TITLE	METHODOLOGICAL DESIGN	RESULTS	CONCLUSIONS	EVIDENCE LEVEL
A-6	Gaspar, <i>et al.</i> Brasil, 2020 <sup>14</sup>	Social inequality and hospitalizations for pneumonia in children under five years of age in the State of Maranhão, Brazil	Ecological study	Pneumonia was the leading cause of hospitalization (57%), predominantly occurring during the months of higher rainfall (February to June) and in municipalities with worse socioeconomic indicators. Hospitalization rates declined over the period, and significant spatial clusters of cases were observed in the southern part of the state, while the metropolitan region of São Luís showed the lowest proportions ( $p < 0.05$ ).	Pneumonia was a significant cause of childhood hospitalization, whose distribution reflects socioeconomic conditions and the quality of life and health in Maranhão.	EL-4
A-7	Freitas, <i>et al.</i> Brasil, 2020 <sup>15</sup>	Hospitalizations for Primary Care-Sensitive Conditions in children in Rondônia, 2008–2017	Ecological study	Infectious gastroenteritis was the leading cause of hospitalization in all age groups. In children under one year of age, hospitalizations for pulmonary diseases, ear, nose, and throat infections, and urinary tract infections were particularly notable, with an observed increase in conditions related to prenatal care and delivery. Epilepsy and skin and subcutaneous tissue infections showed an upward trend in hospitalizations across all age groups.	High rates of childhood hospitalization highlight the fragility of the health care network, reinforcing the importance of this study for public policies aimed at Primary Child Health Care.	EL-4
A-8	Aurilio, Sant'Anna e March Brasil, 2020 <sup>16</sup>	Clinical profile of children with and without comorbidities hospitalized with community-acquired pneumonia	Observational, cross-sectional, descriptive study	A total of 121 cases were analyzed, with 47.9% presenting comorbidities. In multivariable analysis, independent predictors of community-acquired pneumonia were: age $> 60$ months (RR = 5.39; $p = 0.002$ ), malnutrition (RR = 1.75; $p = 0.008$ ), prior antimicrobial use (RR = 3.03; $p = 0.013$ ), and previous hospitalization for pneumonia (RR = 2.91; $p = 0.035$ ).	Most patients with community-acquired pneumonia and comorbidities were older than 60 months, had malnutrition, prior antibiotic use, and a history of hospitalization for pneumonia. Comorbidities were associated with higher risk of malnutrition and recurrent pneumonia hospitalizations in older children.	EL-6
A-9	Lôbo, <i>et al.</i> Brasil, 2019 <sup>2</sup>	Hospitalizations for Primary Care-Sensitive Conditions in Children Under One Year of Age, 2008–2014, in the State of São Paulo, Brazil	Ecological study with descriptive and analytical characteristics	A total of 851,713 hospitalizations in children under one year of age were recorded, of which 22.6% were for primary care-sensitive conditions. Reductions were observed in bacterial pneumonia (-7.1%) and nutritional deficiencies (-7.7%) in the early neonatal period. There were increases in prenatal- and delivery-related diseases (+10.1%) and in vaccine-preventable and avoidable conditions in the post-neonatal period (+14.1%), such as whooping cough and congenital syphilis.	The results highlight weaknesses in child health care at the primary care level in São Paulo. The observed hospitalization trends may inform the planning of actions aimed at reducing morbidity and optimizing resources at the tertiary level of health care.	EL-4
A-10	Farias, <i>et al.</i> Brasil, 2019 <sup>17</sup>	Ethnic-racial inequities in hospitalizations for preventable causes in children under five years of age in Brazil, 2009–2014	Descriptive study	Respiratory diseases (37.4%) and infectious and parasitic diseases (19.3%) were the leading causes of hospitalization, with greater impact among indigenous children. HPCSC rates per 1,000 inhabitants were highest in this group (97.3), followed by mixed-race (40.0) and lowest among East Asian-descent children (14.8). Adjusted rate ratios indicated greater vulnerability among indigenous children relative to white children, particularly in the North (5.9) and Center-West (18.5) regions.	Acute respiratory infections remain important causes of childhood hospitalization in Brazil. Ethnic-racial inequities in rates of hospitalization for primary care-sensitive conditions persist, with greater vulnerability among indigenous children.	EL-6

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CODE	AUTHORS COUNTRY/YEAR	TITLE	METHODOLOGICAL DESIGN	RESULTS	CONCLUSIONS	EVIDENCE LEVEL
A-11	Macedo, <i>et al.</i> Brasil, 2019 <sup>18</sup>	Factors associated with pneumonia and diarrhea in children and quality of Primary Health Care	Cross-sectional study	In logistic analysis, receipt of social assistance (95% CI) and good accessibility to Primary Health Care (95% CI) were identified as possible protective factors against diarrhea. For pneumonia, inadequate access to primary care was identified as a risk factor (95% CI), while appropriate care coordination showed a protective effect (95% CI).	PHC utilization was associated with lower odds of hospitalization for pneumonia, a condition sensitive to this level of care. Good family income and the child's good accessibility to the health unit were also protective factors against diarrhea episodes.	EL-6
A-12	César e Nascimento. Brasil, 2018 <sup>19</sup>	Coarse particles and hospital admissions for respiratory diseases in children: an ecological time-series study	Ecological time-series study	A total of 638 hospitalizations were recorded over the period, with a mean of 1.75 daily cases. Mean concentrations were 22.45 µg/m <sup>3</sup> for coarse particles (PM <sub>10-2.5</sub> ) and 13.32 µg/m <sup>3</sup> for fine particles. PM <sub>10-2.5</sub> showed significant risk only at lags 0 (RR = 1.012) and 6 (RR = 1.011). A 5 µg/m <sup>3</sup> increase in this fraction was associated with up to a 4.8% increase in hospitalizations, corresponding to 72 additional cases and an estimated annual cost of US\$ 17,000.	The coarse fraction of particulate matter influenced the increase in hospitalizations for respiratory diseases in children, both on the day of exposure and up to six days after. Concentrations of this fraction were also higher than those of fine particulate matter.	EL-4
A-13	Souza, <i>et al.</i> Brasil, 2018 <sup>20</sup>	Socioeconomic factors and risk of hospitalization for asthma in municipalities of Mato Grosso, Brazil	Ecological study	Between 2001 and 2012, respiratory diseases accounted for 17% of hospitalizations in Mato Grosso. In children under five years of age, this group of causes represented 68% of hospitalizations, with asthma responsible for 13% of them. Over the period, the SIH/SUS registered 17,975 asthma hospitalizations in children of this age group, residing in 141 municipalities in the state.	Municipalities with better socioeconomic conditions showed lower hospitalization rates. A 76% reduction in hospitalizations was observed over 12 years, particularly after 2005. The highest childhood hospitalization rates for asthma occurred in municipalities with high incidence of fires and low development indices.	EL-4
A-14	Vieira e Kupek. Brasil, 2018 <sup>21</sup>	Impact of the pneumococcal vaccine on the reduction of hospital admissions for pneumonia in children under five years in Santa Catarina, 2006–2014	Ecological study	Comparing pre- and post-vaccination periods, reductions in pneumonia hospitalizations in children under one year of age were observed, ranging from -44.1% in the Western region to -1.4% in the Planalto Serrano. Among children aged 1 to 4 years, the variation ranged from -37.1% in the Planalto Norte to 16.9% in the Planalto Serrano (p < 0.05). Overall, hospitalization rates decreased by 23.3% in children under one year of age and by 8.4% among those aged 1 to 4 years in the state.	A significant reduction in pneumonia hospitalizations in children under one year of age was observed, indicating the effectiveness of vaccination.	EL-4
A-15	Nascimento, <i>et al.</i> Brasil, 2017 <sup>22</sup>	Association between fine particulate matter concentration in the atmosphere and acute respiratory diseases in children	Ecological study	A 4.2 µg/m <sup>3</sup> increase in fine particulate matter concentration elevated the risk of medical care by 3.8% on the same day and of hospitalization by 5.6% six days after exposure.	A positive association was found between fine particulate matter concentration in the air and the increase in outpatient visits and hospitalizations for acute respiratory diseases in children under 12 years of age.	EL-4
A-16	Pina, <i>et al.</i> Brasil, 2017 <sup>23</sup>	Role of Primary Health Care in the hospitalization of children for pneumonia: a case-control study	Case-control study	Protective factors identified were: family income above US\$ 216.12, gestational weight gain ≥10 kg, better quality of Primary Health Care, presence of gastroesophageal reflux, excess weight, and birth interval ≥48 months. Risk factors included higher number of deliveries, vaccination delay, malnutrition, history of wheezing, daycare attendance, and recent medication use.	Prioritization of Primary Health Care, with emphasis on nutritional follow-up, immunization, management of prevalent diseases, prenatal care, and family planning, is essential to reduce childhood hospitalizations for pneumonia.	EL-4

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CODE	AUTHORS COUNTRY/YEAR	TITLE	METHODOLOGICAL DESIGN	RESULTS	CONCLUSIONS	EVIDENCE LEVEL
A-17	Silva, <i>et al.</i> Brasil, 2016 <sup>24</sup>	Impact of the 10-valent pneumococcal conjugate vaccine on the reduction of hospitalizations for community-acquired pneumonia in children	Ecological study	In the 26 municipalities of the Regional Health Superintendency of Alfenas (MG), a significant reduction in community-acquired pneumonia hospitalizations in children under one year of age was observed, with PR = 0.81 (95% CI: 0.74–0.89; p < 0.05), representing a 19% decrease in the post-vaccination period.	The 10-valent pneumococcal conjugate vaccine was effective in preventing severe cases of community-acquired pneumonia in children under one year of age.	EL-4
A-18	Brito, <i>et al.</i> Brasil, 2016 <sup>25</sup>	Clinical characteristics and outcomes of acute community pneumonia in children hospitalized at a public referral service in Pernambuco, Brazil (2010–2011)	Retrospective study	Severe pneumonia with pleural effusion was more common in children under five years of age (p = 0.025) and was associated with fever and cough for longer periods (19 and 17 days, respectively). There were six deaths (7.5%), half of which occurred before the fourth day of hospitalization (p = 0.001), all in children from inland areas with pleural effusion (p = 0.026).	The severity of pneumonia in children seen at this hospital was associated with younger age and inland origin, where infrastructure limitations and health resources hinder early diagnosis and appropriate medical intervention.	EL-4
A-19	Patto, <i>et al.</i> Brasil, 2016 <sup>26</sup>	Fine particulate matter exposure and hospitalizations for pneumonia: Effects on number of hospitalizations and their costs	Ecological study	Between 2011 and 2013, 1,161 children were hospitalized. The mean PM2.5 concentration was 18.7 µg/m <sup>3</sup> (equivalent to approximately 32 µg/m <sup>3</sup> of PM10). Exposure to this pollutant was associated with an increase in hospitalizations four to five days after exposure.	A reduction of 10 µg/m <sup>3</sup> in PM2.5 concentration could prevent approximately 256 hospitalizations and generate savings of approximately R\$ 220,000 in a medium-sized city.	EL-4
A-20	Souza e Nascimento Brasil, 2016 <sup>3</sup>	Atmospheric pollutants and hospitalizations for pneumonia in children: a time-series study	Ecological study	A total of 234 hospitalizations were recorded over three years, with a strong association between cases and levels of PM10 and NO <sub>2</sub> . The attributable relative risk (ARR) was 15 ppt for PM10 on the day of exposure and 7 ppt one day after NO <sub>2</sub> exposure.	Air pollution influenced pneumonia hospitalizations in a medium-sized city located in a region affected by sugarcane straw burning.	EL-4
A-21	Machado, <i>et al.</i> Brasil, 2016 <sup>27</sup>	Hospitalizations for acute lower respiratory tract infections of probable viral etiology in children during 2012: a care strategy	Descriptive, retrospective study	In 2012, 887 children were discharged, corresponding to 25.5% of all hospital discharges. The mean age was 4 months, and fewer than 10% had risk factors for severe disease. The respiratory syncytial virus (RSV) was the most frequently identified pathogen. A diagnostic and treatment protocol was adopted, with the use of transitional care rooms. Non-invasive ventilation was applied in 87 children, with 80% success, and high-flow oxygen therapy in 22, with 100% success. In total, 149 children were admitted to the ICU, of whom 55.7% required mechanical ventilation. Six deaths occurred — two in the intermediate care unit and four in the ICU.	Acute Lower Respiratory Tract Infection (ALRTI) was one of the leading causes of morbidity and mortality during the analyzed period. Most hospitalized children were young, and a significant proportion presented severe forms of disease requiring specialized treatment. The need to continuously improve therapeutic strategies for this group is emphasized.	EL-6
A-22	César, <i>et al.</i> Brasil, 2016 <sup>28</sup>	Fine particulate matter estimated by mathematical model and hospitalizations for pneumonia and asthma in children	Ecological study	A significant association was found between fine particulate matter concentration and increased hospitalizations for pneumonia and asthma. Increases in this pollutant elevated the risk of hospitalizations, while its reduction could prevent approximately 38 hospitalizations.	Exposure to fine particles was associated with increased hospitalizations for pneumonia and asthma in children under 10 years of age, demonstrating the impact of fine particulate matter on child health and the need for preventive measures.	EL-4

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CODE	AUTHORS COUNTRY/YEAR	TITLE	METHODOLOGICAL DESIGN	RESULTS	CONCLUSIONS	EVIDENCE LEVEL
A-23	Freitas, et al. Brasil, 2016 <sup>29</sup>	Air pollution and health impacts in Vitória, Espírito Santo, Brazil	Ecological study	A 10 µg/m <sup>3</sup> increase in PM <sub>10</sub> , SO <sub>2</sub> , and O <sub>3</sub> levels was associated with a higher risk of hospitalizations for respiratory diseases, especially in children under five years of age. Additionally, a significant association was observed between O <sub>3</sub> and cardiovascular diseases.	Respiratory diseases showed the strongest and most consistent association with the atmospheric pollutants analyzed in Vitória.	EL-4
A-24	Tuan, Venâncio e Nascimento Brasil, 2015 <sup>30</sup>	Atmospheric pollutants and hospitalizations for pneumonia in children: ecological time-series study	Ecological study	A total of 539 hospitalizations were recorded, with an association between CO and O <sub>3</sub> exposure and an increase in cases three days after exposure. Particulate matter and sulfur dioxide did not show a significant relationship. A reduction in CO and O <sub>3</sub> concentrations could prevent approximately 49 hospitalizations and generate savings of approximately R\$ 39,000.	Exposure to atmospheric pollutants may cause adverse impacts on child health, reinforcing the need for public policies aimed at reducing emissions of these contaminants.	EL-4
A-25	Santos, et al. Brasil, 2015 <sup>31</sup>	Hospitalization of children for primary care-sensitive conditions	Descriptive study	A total of 16,156 hospitalizations were recorded, of which 6,258 (38.7%) were for primary care-sensitive conditions, predominantly in children aged 1 to 4 years (3,697 cases). The most frequent causes were bacterial pneumonia, pulmonary diseases, infectious gastroenteritis and its complications. Hospitalization indices remained stable throughout the period, with a slight decrease in 2010 and 2011.	Despite the reduction in hospitalizations for primary care-sensitive conditions, the results suggest possible deficiencies in the quality of health care in the analyzed municipality.	EL-6
A-26	Carvalho, Nakazato e Nascimento Brasil, 2016 <sup>32</sup>	NO <sub>2</sub> exposure and hospitalizations of children for respiratory diseases in Ribeirão Preto	Ecological, time-series study	The study, conducted between 2011 and 2013, analyzed the relationship between hospital admissions and the pollutants PM <sub>10</sub> , NO <sub>2</sub> , and O <sub>3</sub> , also considering temperature and humidity. NO <sub>2</sub> showed a significant association with hospitalizations, resulting in approximately 150 additional hospitalizations and higher costs to the public health system.	The results provide support for local health managers to adopt measures aimed at reducing the impacts of atmospheric pollutants on the population.	EL-4
A-27	Moura et al. Brasil, 2017 <sup>33</sup>	Complex chronic conditions in children and adolescents: hospitalizations in Brazil, 2013	Descriptive study	In 2013, public hospitals recorded approximately 190,000 pediatric admissions. The highest rates occurred in the South of the country, among boys and children under one year of age, while the lowest were observed in the North, among girls and children aged 10 to 14 years. The mean length of hospital stay was six days. The main causes of hospitalization were respiratory diseases, neoplasms, and nervous system diseases. The incidence of hospitalization for complex chronic conditions was 331 per 100,000 children and adolescents, totaling approximately 240,000 cases in the country.	This scenario presents complex chronic diseases as an emerging public health problem in Brazil. The main causes identified were respiratory system diseases, including asthma, as well as neoplasms and nervous system diseases, including epilepsy, cerebral palsy, and other paralytic syndromes.	EL-6
A-28	Menezes, Pavanitto e Nascimento. Brasil, 2019 <sup>34</sup>	Air pollutant exposure and respiratory disease in boys and girls	Ecological, time-series study	A total of 1,165 children were hospitalized. The mean PM <sub>2.5</sub> concentration was 15.1±2.9 µg/m <sup>3</sup> . No significant association was found between exposure and hospitalizations among boys; however, among girls, an increased risk of hospitalization for respiratory diseases was observed. A 5 µg/m <sup>3</sup> increase in PM <sub>2.5</sub> elevated the risk by 18%, resulting in approximately 95 additional hospitalizations and additional costs of approximately US\$ 35,000.	A significant association was found between fine particulate matter exposure and the increase in daily hospitalizations for respiratory diseases in girls, indicating the importance of considering sex as a stratification variable in future studies.	EL-4

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CODE	AUTHORS COUNTRY/YEAR	TITLE	METHODOLOGICAL DESIGN	RESULTS	CONCLUSIONS	EVIDENCE LEVEL
A-29	Silva <i>et al.</i> Brasil, 2017 <sup>35</sup>	Characteristics and factors associated with hospitalization in the first years of life: birth cohort from Pelotas, Rio Grande do Sul, Brazil, 2004	Cohort study	The main causes of hospitalization were respiratory diseases, followed by infectious and parasitic diseases. Previous hospitalization stood out as a strong predictor of new admissions. Factors such as low birth weight, prematurity, low Apgar score, sex, type of pregnancy, maternal smoking, maternal skin color, and low family income were also associated with a higher number of hospitalizations.	The results underscore the need to concentrate efforts on reducing hospitalizations for respiratory diseases, with priority for children under one year of age.	EL-4
A-30	Xavier <i>et al.</i> Brasil, 2022 <sup>36</sup>	Climatic seasonality and lower respiratory tract diseases: use of a predictive model for pediatric hospitalizations	Cohort, observational study	Between 1998 and 2020, Campina Grande (PB) recorded 37,026 hospitalizations for pneumonia, asthma, and bronchitis/bronchiolitis, with pneumonia accounting for 66% of cases. Hospitalizations occurred mainly between April and August, coinciding with the period of higher rainfall and lower temperatures. Most cases were concentrated in children aged 1 to 4 years. A significant reduction in pneumonia hospitalizations was observed over the years, attributed to prevention and health promotion actions, with a downward trend confirmed by the SARIMA model.	There was a relationship between seasonality and morbidities, with higher incidence in autumn and winter. The SARIMA model confirmed the influence of climate on hospitalizations for pneumonia, bronchitis/bronchiolitis, and asthma, predicting a continued reduction in pneumonia cases, a slight increase for bronchitis/bronchiolitis, and stability in asthma hospitalizations between 2021 and 2022.	EL-4

**Figure 2** - Characterization of articles selected for the integrative review. Santa Maria, RS, Brazil, 2024.

After applying the selection criteria, 30 articles were selected, all from Brazil; none were conducted in Guinea-Bissau, which represents a gap in knowledge regarding pediatric respiratory disease hospitalizations in that setting. Regarding year of publication, two studies were published in 2015, eight in 2016, five in 2017, four in 2018, five in 2019, four in 2020, one in 2021, and one in 2022.

The included studies are from the following fields: 15 from Medicine, seven from Nursing, six from Public/Collective Health, one from Environmental Sciences, and one from Human Geography. Regarding the evidence level (EL) of the included studies, 23 were classified as EL-4 and seven as EL-6.

It was found that the leading cause of childhood

hospitalization is related to primary care-sensitive conditions, with pneumonia being one of the most prevalent causes of hospital admissions in children under five years of age.

Based on content analysis of the selected studies, the following main themes related to the study objective were identified: exposure to air pollution; viral infections, especially by the respiratory syncytial virus (RSV); geographic factors; residence in areas of social and economic vulnerability; absence of basic sanitation; early interruption of breastfeeding; presence of comorbidities, such as malnutrition and chronic diseases, associated with greater risk of hospitalization for pneumonia; and low vaccination coverage, considered a risk factor for hospitalizations for respiratory diseases in children.

## DISCUSSION

The primary infection compromises the lower respiratory tract, especially in infants under six months of age, who are more vulnerable to severe infections due to the immaturity of the immune system. In this regard, evidence found during the research suggests that primary care-sensitive conditions and RSV infections are the most frequent causes of hospital admissions in children with re-

spiratory diseases<sup>27,36</sup>.

In Brazil, respiratory infections are the leading cause of hospitalization in children under five years of age. In this context, the fragility of the current care network calls for the implementation of policies and programs – such as prevention and health education – aimed at reducing childhood morbimortality<sup>2,9,15</sup>. Furthermore, it is understood that

the prioritization of certain child and family health care practices, such as growth and development monitoring, nutrition, immunizations, and prenatal care, constitutes an effective strategy for reducing the childhood hospitalization rate for respiratory diseases such as pneumonia<sup>23</sup>.

Analogously, other scientific studies have identified prenatal quality and care, obstetric assistance, vaccination coverage, and encouragement of exclusive breastfeeding as strategies for reducing the occurrence of respiratory diseases<sup>37</sup>.

Prevention and health education actions developed in PHC can be effective; however, when the services offered do not meet the population's needs, individuals are subject to the development of primary care-sensitive conditions, such as respiratory infections in childhood and the resulting hospitalizations<sup>38,39</sup>.

With regard to the tertiary level of health care, the fragility of infrastructure and scarcity of resources in public hospitals for the management of children with community-acquired pneumonia compromise early diagnosis and, consequently, worsen clinical prognosis<sup>25</sup>.

Timely and qualified access to PHC, as the entry point for individuals into the Unified Health System, is essential in combating Acute Respiratory Infections (ARIs)<sup>17</sup>. In this regard, access to primary care has been associated with respiratory disease hospitalization, with evidence indicating that PHC attendance resulted in a greater probability of non-hospitalization for pneumonia<sup>18</sup>.

Conversely, another study conducted in a Brazilian municipality addressed hospitalizations related to primary care-sensitive conditions, including respiratory conditions, and concluded from its findings that there are deficiencies in the quality of PHC, which may contribute to increased hospitalization for such conditions<sup>31</sup>.

In childhood, ARIs are primarily responsible for community-acquired pneumonia, which may result from bacterial or viral processes<sup>40,20</sup>. In Guinea-Bissau, difficulties in performing laboratory tests to identify viruses, and the lack of clinical-radiological examinations – particularly in the country's interior – make it difficult to distinguish viral from bacterial infections<sup>41</sup>.

One action to be strengthened in PHC is childhood vaccination. This assertion is supported by several studies in which a reduction in pneumonia hospitalization rates in children under one year of age was observed, possibly related to increased coverage and the effectiveness of the pneumococcal vaccine<sup>21,24</sup>. Furthermore, evidence points to low vaccination rates as a predictor of childhood

hospitalizations for whooping cough<sup>13</sup>.

Moreover, the importance of broad vaccination coverage against the main microorganisms responsible for respiratory diseases in children becomes clear when considering data on the severity of RSV infection and how the absence of the respective vaccine in Primary Health Care contributes to worse prognoses and increased hospitalization rates<sup>36</sup>.

Another factor directly related to the occurrence of pediatric hospitalizations for ARIs is family socioeconomic vulnerability. Numerous studies demonstrate how social and economic characteristics, and their associated factors – such as malnutrition – contribute to the development of pneumonia and other respiratory diseases<sup>14,16</sup>.

In this regard, burning activities and low municipal development indices are associated with a higher risk of childhood hospitalization resulting from asthmatic exacerbation<sup>11</sup>. Such vulnerability conditions suggest recurring hospitalizations related to respiratory factors in children; accordingly, the occurrence of prior hospitalizations may be understood as a risk factor for multiple hospitalizations<sup>35</sup>.

In Guinea-Bissau, there is clear evidence of precarious basic sanitation across the entire territory. In urban areas, accumulation of solid waste from various sources is observed on public roads. In rural areas, although more than half of the population uses treated water, a significant proportion still depends on water from wells – a condition associated with high rates of diarrheal diseases, malaria, and respiratory infections in the country<sup>41</sup>.

Geographic location and environmental attributes may affect lung function, directly contributing to the emergence of influenza, rhinitis, bronchitis, and the worsening of chronic conditions such as asthma, as well as favoring the proliferation of viruses, bacteria, molds, and fungi<sup>42,43</sup>. These factors may affect children even more intensely, given their greater vulnerability and susceptibility to climatic changes and the duration of pollutant exposure, significantly contributing to the development of respiratory diseases in childhood.

In this context, seasonality may be associated with the development of bronchitis and bronchiolitis in children, and with increased morbidity from such diseases during autumn and winter<sup>36</sup>. Furthermore, evidence in the scientific literature links relative air humidity, precipitation, and atmospheric pollution to pediatric illness – particularly among girls – related to respiratory conditions and, consequently, to hospitalizations resulting from clinical deterioration due to such factors<sup>30,12</sup>.

Every year, during the cold months, upper and lower respiratory tract infections increase, leading to a rise in the demand for urgent care and pediatric hospitalizations<sup>44,45</sup>. The severity of infections in the first six months of life has repercussions for the need for intensive care, leading some of these children to death from pulmonary sequelae and/or septicemia<sup>44</sup>.

Regarding air pollution, this was identified as a contributor to respiratory infections culminating in hospitalizations – primarily related to particles from industrial combustion sources, which may exhibit greater toxicity<sup>10,19,22,26,28</sup>.

Air pollution is one of the causes of hospital admissions in children under one year of age worldwide; this effect, which includes high mortality rates from small air pollution particles, is represented by concentrations of PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, SO<sub>2</sub>, and O<sub>3</sub>, which are associated with an increase in these events and primarily affect the respiratory system of the population<sup>3,32,34,29</sup>. Addi-

tionally, the synergistic effect of the combination of respirable particles and environmental viruses has been identified as a risk factor for pneumonia-related hospitalizations<sup>46</sup>.

With regard to chronic respiratory diseases in children, these are recognized as an emerging public health problem in Brazil and as a cause of hospitalizations resulting from their exacerbation<sup>33</sup>. Children with chronic conditions exposed to adverse environments have twice the probability of hospitalization compared to those without such conditions<sup>47</sup>.

Furthermore, it is noteworthy that children with chronic conditions have up to twice the probability of being hospitalized compared to their peers and, when hospitalized, face a higher risk of morbidity and disability<sup>47</sup>. In underdeveloped countries, the absence of the state, the lack of prevention, health promotion, and health education are reflected in low health service utilization by users at the onset of symptom appearance.

## CONCLUSION

Scientific evidence identified in the literature indicates that hospital admissions for respiratory diseases are influenced by inadequate socioeconomic and environmental conditions, atmospheric pollution, vaccination coverage, and difficulties in accessing Primary Health Care.

Considering that this review aimed to support a study with Guinea-Bissau as its setting, the absence of publications from that country also constitutes a finding of the study, reinforcing the need for actions and studies addressing this topic. It is known that respiratory diseases are highly prevalent in that country. Therefore, studies including the Guinean child population are recommended, encouraging the development of research in favor of child health in that

country.

Most studies of an epidemiological nature presented moderate strength of evidence for inferences in clinical practice. However, these studies aim to highlight the Brazilian epidemiological profile and encourage research in sub-Saharan African countries, with a view to diagnosing epidemiological gaps and building local indicators.

Intervention studies with this population are recommended, promoting in-service education for professionals and health education for family caregivers, in order to reduce hospitalization rates and the consequent morbimortality from respiratory diseases in childhood, based on the evidence described in this investigation.

### CRedit author statement

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