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PATHOGENESIS OF RESPIRATORY SYNDROMES IN CHILDREN IN BRAZIL: AN INTEGRATIVE REVIEW IN THE CONTEXT OF EPIDEMIOLOGY

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Abstract: Respiratory syndromes in children are recurrent pathologies that affect the respiratory system and can be associated with several factors. In this sense, we intend to address the main pathogenesis of respiratory syndromes in children in the Brazilian context, adopting an epidemiological approach. Understanding the pathogenicity of respiratory syndromes favors the formulation of public policies that aim to reduce the impacts of these diseases on the pediatric population. The importance of environmental interventions and the provision of comprehensive child health care is highlighted with the aim of reversing respiratory syndromic conditions.
Keywords: Respiratory syndromes, children, seasonality, environment, pollution, microorganisms.

INTRODUCTION

Respiratory syndromes, routinely found as complaints in hospitals and outpatient clinics, have persisted on Brazilian soil for years. In the 16th century, when the Portuguese and new pathogens arrived in Brazil, medical and epidemiological information was limited and there was no understanding of the causes and transmission of respiratory diseases as we have today. Modern respiratory syndromes have an epidemiological history resulting from urbanization, demographic changes and recent epidemiological events in global history (LIMA, 2010).

The pathogenesis of respiratory diseases begins with exposure to triggering factors, such as pathogens, irritants or autoimmune conditions. This exposure triggers an inflammatory response in the respiratory system, which can cause damage to lung tissue and airways, leading to excessive mucus production and obstruction of air passages. As the pathogenesis progresses, individuals may experience respiratory symptoms such as shortness of breath, coughing, wheezing, and fatigue. Proper diagnosis is critical, and treatment may include medications to control inflammation, dilate the airways, treat infections, and other approaches to manage symptoms and disease progression. (RIBEIRO, 2023)

In Brazil, as in many other places around the world, several respiratory syndromes are prevalent due to factors such as climate, exposure to atmospheric pollutants and the spread of pathogens. (OLIVEIRA, 2020)

Furthermore, chronic respiratory diseases affect both the upper and lower airways. Estimates on the prevalence of lung disease have been based primarily on mortality statistics, which constitutes an underdiagnosis (GOUVEIA, 2019). Thus, these estimates show that morbidity and mortality from respiratory diseases may be even higher in many regions, with prevalence particularly among children and the elderly.

Brazil ranks eighth worldwide in asthma prevalence, with estimates for school-age children and adolescents ranging from less than 10% to more than 20% in several cities studied, depending on the region and age group considered. Following the Guidelines of the National Medicines Policy (PNM), the Ministry of Health has been implementing in recent years the process of decentralization of federal resources destined to the cost of medicines used in the scope of Primary Care, including those intended for the treatment of syndromes respiratory. From April 2006, based on GM Ordinance No. 2,084, of October 26, 2005, the process of decentralization of federal resources intended to cover asthma and rhinitis medications began. Therefore, it is up to managers to include these medicines among Primary Care medicines, in accordance with regional epidemiological needs, using the National List of Essential Medicines (RENAME) as a guiding instrument).

It is in this aspect that epidemiology plays a fundamental role in understanding and controlling diseases, as it seeks to identify and analyze the determining factors of health that vary according to the season and the region in question. Understanding this seasonal variation is essential for planning public health interventions, allocating resources appropriately, and implementing effective preventive strategies. Furthermore, considering the specific characteristics of each location is essential to direct health policies more precisely, thus promoting prevention, early detection and effective control of illnesses (GOUVEIA, 2019).

Therefore, it is extremely important to understand the factors that trigger the signs and symptoms of respiratory syndromes in the target audience in question. In this sense, several elements play a critical role in the pathogenesis of these conditions, including environmental, social and behavioral factors. In the Brazilian scenario, exposure to atmospheric pollutants, such as air pollution, plays a preponderant role in the incidence of respiratory diseases in children (MORAES, 2019).

The aim is to address a health issue present in the country's epidemiological context. The non-specificity of the history of respiratory syndromes, from the beginning of the increase in cases to their spread in Brazil, reveals the magnitude of the challenges faced by public health in the region. Since the first records of cases in the national territory, respiratory syndromes have assumed a critical role in childhood morbidity (MENEZES, 2019), demanding effective prevention and control approaches.

It is worth highlighting that carrying out a study addressing the causes of respiratory diseases in children in a post-pandemic period consisting of a respiratory syndrome, Covid-19, presents challenges and limitations, namely, the possibility of impacting incidence patterns, which can influence the understanding of the data collected. Furthermore, access to sources that address respiratory syndromes in some regions of Brazil, such as the North and Northeast, is a significant challenge.

OBJECTIVE

Understand the possible causes of cases of childhood respiratory syndromes in Brazil.

MATERIALS AND METHOD

This is an integrative literary review, which was carried out between August and October 2023. The database used involved the Scielo, Pubmed and Lilacs platforms. The descriptors were chosen based on the Health Science Descriptors (DeCS): "respiratory diseases", "respiratory infections", "child health" and "Brazil"; They were used in Portuguese and English and were chosen differentially in each database every two or every three. The inclusion criteria involved longitudinal, cohort, quantitative and qualitative observational studies, complete cross-sectional studies and retrospective studies, free of charge, in Portuguese and English, published between the years 2018 and 2023. The time interval of the research considered identifying the latest weather-related publications. The exclusion criteria took into account incomplete, paid articles, conference proceedings, theses and dissertations, review articles and articles that addressed respiratory syndromes in other countries, limiting the search to Brazil. Based on the criteria, 350 articles were initially found. Then, the articles were selected by reading the titles and abstracts to identify which ones were related to the proposed topic and the identification of duplicate articles. As a result, 15 articles were identified that address the research objectives. In particular, Azevedo's work from 2015 was included in the

sample given its relevance to the topic.

RESULTS AND DISCUSSION

After reading the articles, we noticed common subtopics that will be discussed below.

Respiratory syndromes is a broad term that refers to a group of health conditions that affect the respiratory system, being the most common nosological conditions in pediatrics. Among the main diseases observed in the literature, the most frequently mentioned acute conditions were: pneumonia, pneumonitis, influenza, acute bronchiolitis, acute bronchitis, acute asthma, pharyngitis, otitis and sinusitis; and the chronic conditions were: asthma, chronic bronchitis, chronic obstructive pulmonary disease (COPD), allergic rhinitis, cystic fibrosis and pulmonary tuberculosis (PASSOS, et al. 2018).

REGIONALIDADE REGIONALITY

Regionally, respiratory diseases in southern Brazil are influenced by different climatic and pathological factors. The predominant climate in the region is subtropical, characterized by cold and wet winters, and this plays an important role in the increase in respiratory syndromes. Southern cities face harsh winters, with low temperatures and high humidity, creating favorable conditions for the emergence of diseases such as flu, colds, bronchitis and pneumonia. The population concentration in urban areas, where people have greater interaction, can intensify the transmission of these diseases (OLIVEIRA, 2020).

Respiratory diseases in Southeast Brazil cover a wide variety of conditions that affect the respiratory health of the population in this region. The diverse climate plays an important role, as some areas have subtropical characteristics while others are tropical. In cities located in subtropical regions, climate changes throughout the year - with colder, drier winters and hot, humid summers - can increase the occurrence of flu, colds and other seasonal infections of the respiratory system. In addition to climatic factors, the high population density and intense urbanization in large cities, such as São Paulo (MORAES, et al. 2019), can facilitate the spread of these respiratory diseases. Exposure to atmospheric pollutants, common in urban areas due to traffic and industrial activity, can also influence respiratory conditions (MATOS, et al. 2019) and (GOUVEIA, et al. 2019).

In relation to the Brazilian Northeast, a region known for historically high infant mortality rates, it is observed that respiratory syndromes constitute the main cause of mortality per year in children under 5 years of age (OLIVEIRA, et al. 2020).

The rainy season recorded the highest numbers of cases. This behavior is associated with higher temperatures, higher relative humidity, higher insolation rate, increased wind speed and increased atmospheric pressure (XAVIER, et al). Pneumonia was observed as the main disease that causes deaths. (OLIVEIRA, *et al.* 2020).

None of the articles now researched identified data on the configuration of respiratory syndromes in the North and Central-West regions, requiring future research in these regions.

AVOIDABLE AND NON-AVOIDABLE FACTORS

Children constitute a population more susceptible to the development of respiratory diseases, as their immune system is not fully developed (OLIVEIRA, et al. 2020). Preventable causes are behaviors that, if avoided, contribute to reducing the chances of developing a certain disease. The main preventable causes are associated with constant exposure to air pollutants, contact

AUTHOR, YEAR, PLACE OF PUBLICATION	OBJECTIVES OF THE ARTICLE	RESULTS FOUND
Azevedo. et al; 2015; Brazilian meteorology magazine.	Analyze the influence of climate on the incidence of acute respiratory infections in children.	Only air temperature and humidity were significant in representing the incidence of AKI in children under 2 years of age.
Filho J., et al; 2021, Emerging Infectious Diseases.	Analyze the perinatal consequences of seasonal influenza transmission misalignment through immunization tracking.	The precariousness of influenza vaccination campaigns negatively affects perinatal outcomes.
Freitas, F. T. De M. et al.; 2023; Paul Pediatric Magazine.	To evaluate the prevalence of respiratory syndrome in a pediatric unit.	There is a need for faster delivery of results so that the use of unnecessary medications is avoided.
Gouveia N., et al; 2019, Science & Public Health.	To examine the impact of air pollution on hospitalizations of children under five years of age and for cardiovascular diseases in those over 39 years of age.	Particulate matter has been linked to respiratory diseases in children and cardiovascular diseases. SO2 and CO also showed an association.
Matos E., et al; 2019, Public Health Notebooks.	Investigate the association between air pollution and care for respiratory diseases in children aged 0 to 6 years.	The pollutants PM10, SO2, NO2 and O3 pose a greater risk for care for respiratory diseases in children.
Moraes S., et al; 2019, Public Health Notebooks.	Understand how meteorological attributes and air pollution are related to hospital admissions for respiratory diseases in children.	High relative risk between average air temperature, relative air humidity, precipitation and particulate matter with hospital admissions for respiratory diseases in children.
Oliveira, F. R. C. De. et al.; 2020; Paul Pediatric Magazine.	Report the case of a child with acute respiratory syndrome due to Adenovirus.	It was found that children's respiratory distress is the biggest challenge in the pediatric ICU.
Oliveira I., Moreira E., Andrade F.; 2020, Ciência Plural Magazine.	Assess morbidity and mortality from respiratory causes in children under five years of age in the Northeast.	The prevalence of deaths from pneumonia caused by a microorganism was 70.04%, morbidity from pneumonia was 60% and asthma was 30%.
Passos, et al; 2018,Rev. paul. pediatric.	Analyze the caregiver's degree of understanding of the signs and symptoms of Acute Respiratory Infections (ARI).	499 caregivers were interviewed. Main causes of ARI: Flu syndrome, common cold, pharyngitis and pneumonia. Fever and cough led to seeking care.
Serpa.,et al; 2022;Arq. Asma, Alergia Imunologia.	Identify the effects of air pollutants and toxic chemical compounds on the respiratory system.	Increase in the prevalence of respiratory diseases due to exposure to air pollutants.
Sousa Jr I., et al ; 2021, Virology journal	Report the atypical case of a child with HFMD and severe acute respiratory syndrome, co-infected with EV-D68 and CVA6.	Enterovirus co-infections appear to increase the pathogenic effect of respiratory syndrome diseases.
Souza, p. G. De. et al.; 2021; Braz J Microbiology.	Analyze the prognosis of respiratory syndromes caused by Rhinovirus in comparison with respiratory syndromes caused by other viruses.	There is a predominance of rhinovirus in respiratory diseases with negative tests for Influenza and flu syndrome.
Souza, et al; 2018, Rev. Paul. Pediatr. (Ed. Port., Online)	Present clinic and procedures administered to children under five years of age from the Guarani community hospitalized due to respiratory infections.	The average age was 11 months. ALRI cases: viral (40.8%), bacterial (35.1%), viral-bacterial (24.1%). 53.1% of hospitalizations without clear justification.
Terças-Trettel A., et al; 2019, Revista do Instituto de Medicina Tropical de São Paulo.	Analyze SPCVH in a child from the Pantanal Biome.	The possibility of Hantavirus infection in children should be considered in endemic areas.
Xavier. et al; 2022;Revista Brasileira de Enfermagem.	Analyze the climatic seasonality of respiratory diseases in children aged 0 to 9 years.	Seasonal effect on the number of registered cases, with the highest number of records in October and November.

TABLE 1.0: LIST OF DATA COLLECTED FROM THE SAMPLE ARTICLES

with constant variations in temperature and relative humidity, and precarious housing in places with high rainfall, which contributes to the increase in the proliferation of mold and other allergens. In addition to such environmental factors, the evaluation of children exposed to tobacco smoke was also an avoidable cause observed, highlighting the difficulty in obtaining information about the level of exposure and how this factor contributes to the development of respiratory illnesses in children.

With regard to urban air pollution, it is possible to maintain that air contamination in urban areas is linked to the emission of pollutants from various sources, such as vehicles, industries, human actions and, not least, the immense climate change that the country is facing. These pollutants include fine particles, volatile organic compounds, nitrogen oxides, carbon monoxide, among others. Urban air pollution can have serious impacts on people's health and the environment, contributing to problems such as respiratory diseases, global warming and degradation of air quality (MATOS, et al. 2019).

Climate change plays a significant role in the rise of respiratory illnesses in several ways. Climate change, such as global warming, can lead to extreme weather conditions, more frequent and longer forest fires, and increased air pollution. This can result in higher levels of fine particles and pollutants in the air, which worsens existing respiratory illnesses and increases the risk of developing them. Some main examples are: the increase in carbon dioxide (CO2) concentrations in the atmosphere, which is linked to seasonal allergies; climate change related to deforestation is also linked to the geographic distribution of vectors such as mosquitoes, which transmit several diseases (dengue and malaria), since, in certain cases, they affect the respiratory system; rising temperatures and changes in rainfall patterns can also influence the spread of infectious diseases, such as influenza, which often affect the respiratory system (MORAES, et al. 2019).

Furthermore, meteorological variables must be mentioned, which are directly related to climate variations, which are temperature, humidity, atmospheric pressure, precipitation and wind, in order to play critical roles in characterizing the climate and weather forecasting (MORAES, et al. 2019). Therefore, climate change can worsen existing respiratory illnesses and create conditions that encourage the emergence of new ones, making respiratory health a growing concern in a warming world.

In the microbiological aspect, respiratory syndromes largely arise from infectious processes, the etiological agent of which is microorganisms such as viruses - the main causes of respiratory syndromes (SOUZA, et al. 2018) -, bacteria and fungi. Regarding the pathogens of seasonal respiratory infections of viral origin, the following stand out: Influenza (FILHO, et al. 2021); Human Rhinovirus (HRV) (SOUZA, et al. 2021); Adenovirus, which affects infants and children under 5 years of age more intensely with Respiratory Distress Syndrome (OLIVEIRA, et al. 2020) and Respiratory Syncytial Virus (RSV) (FREITAS, et al. 2023). Less significant viral respiratory infections that are independent of seasonality may be related to Enterovirus (EV) (SOUSA, et al. 2021) and Hantavirus (TERÇAS-TRETTEL, et al. 2019). It is worth highlighting the relevance of the Coronavirus as the pathogen related to Severe Acute Respiratory Syndrome that occurred as a pandemic between 2020 and 2021.

No data were found that addressed respiratory syndromes of bacterial origin, but there is emphasis on gram-positive bacterial genera with morphology in cocci,

such as *Staphylococcus aureus*, *Streptococcus pyogenes* and *Streptococcus pneumoniae*. Furthermore, acid-fast bacilli, such as Mycobacterium tuberculosis, the etiological agent of tuberculosis, also have a major impact on respiratory infections. Regarding respiratory infections of fungal origin, there is a certain emphasis on invasive fungal diseases that affect the respiratory system, such as histoplasmosis, coccidioidomycosis and paracoccidioidomycosis, however they were not addressed in the databases used, verifying the need to create research that addresses these areas among children.

The first factor that explains the higher incidence of respiratory syndromes in infants is the development of children's immune systems. From birth to 6 months of life, the baby does not yet have sufficient immunity and is therefore more susceptible to infections, and breastfeeding is essential during this period to desensitize children to the microbiota and acquire maternal antibodies to eliminate pathogens. Respiratory diseases can have a long-term effect on quality of life, as the problem can become chronic and persist into adulthood. Therefore, at this stage of life, it is extremely important to maintain follow-up with the pediatrician and carry out immunizations on time so that the child grows up healthy (MATOS, et al. 2019).

Furthermore, social determinants of health are important causal factors of respiratory syndromes. Among them, it is worth highlighting the environmental factors of degradation that infants are subjected to in their housing contexts, such as air pollution and fires and deforestation (SERPA, et al. 2022). Furthermore, housing conditions are decisive health determinants in relation to respiratory syndromes, as it is the place where the child will be most constantly and the presence of mold, carpets, stuffed animals and the lack of sunlight are very common situations. in Brazilian housing, not only do they favor children suffering from respiratory diseases, but they also encourage chronic respiratory conditions in the lower respiratory tract, such as asthma, bronchitis and bronchiolitis.

Thus, with social issues as the basis of health determinants, the domestic environment in which these children are inserted plays a vital role in respiratory health. Unfortunately, the majority of the population finds itself living on the margins of society, in irregular housing, without access to basic sanitation, in unhealthy terrain, with the presence of allergens such as dust mites, mold, animal hair and excessive pollution, in addition to the absence of the minimum considered for the scope of a healthy home (PASSOS, 2018).

It is worth noting that the presence of family members or residents who smoke in contact with the child favors their passive exposure to tobacco, which can result in serious respiratory complications, such as asthma. Therefore, recognizing the housing factors that favor the emergence of respiratory syndromes is fundamental for understanding and addressing them, not only taking into account the clinical aspects of respiratory syndromes, but also the promotion of healthy environments in line with family habits, so that the risk of developing these conditions is reduced (PASSOS, 2018).

The relationship between comorbidities and respiratory syndromes in children represents a significant challenge for public health in Brazil. Considering that comorbidities are additional medical conditions that coexist with the primary condition, it is stated that their relationship with respiratory syndromes is complex, as well as multifaceted. In this context, the comorbidities that most impact children's respiratory health are asthma and childhood obesity (OLIVEIRA, et al. 2020). In view of the above, it is clear that early identification combined with effective

management of comorbidities are essential elements for promoting long-lasting, quality child respiratory health.

Immunization promoted by vaccination is an important factor in reducing the incidence of the main respiratory syndromes in Brazilian children. The implementation, in 2010, of the Pneumococcal Conjugate 10 Valente vaccine, in the basic childhood immunization schedule in Brazil, may be strongly associated with the reduction in pneumonia cases over the years under study (XAVIER, et al. 2022). In addition to this, another protection that deserves to be highlighted is the Influenza vaccine, accessible through annual vaccination campaigns, which constitutes a fundamental form of prevention for more serious cases of influenza (FILHO, et al. 2021).

FINAL CONSIDERATIONS

In Brazil, respiratory syndromes vary regionally due to the country's diverse size and climate. In the South and Southeast, winter is associated with a higher incidence, due to the colder and drier climate. In the North and Northeast, with hotter and more humid climates, seasonality is less marked, but allergens and air pollutants can be important factors. Therefore, prevention strategies must consider the country's regional conditions.

Respiratory conditions are also related to microorganisms, with seasonal viruses receiving great emphasis. Respiratory infections of bacterial and fungal origin have not been addressed and require further epidemiological elucidation.

The accelerated urbanization process has resulted in significant changes in living standards, which can worsen respiratory conditions. Advances in the quality of child health care and a drop in the number of child deaths were observed. However, socioeconomic inequalities and access to health services are major obstacles to reducing these rates.

A limitation of the study is the occurrence of the Covid-19 pandemic in March 2020, which resulted in pathological respiratory conditions, impacting how the world population reacts to respiratory diseases. It is essential that there are national studies on the epidemiological aspects of respiratory syndromes after the pandemic period.

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