



**CLIMATE CHANGE AND RESPIRATORY VULNERABILITY: INTERSECTIONS
BETWEEN SOCIAL INEQUALITY, HEALTH AND THE ENVIRONMENT**

**MUDANÇAS CLIMÁTICAS E VULNERABILIDADE RESPIRATÓRIA:
INTERSEÇÕES ENTRE DESIGUALDADE SOCIAL, SAÚDE E MEIO AMBIENTE**

**CAMBIO CLIMÁTICO Y VULNERABILIDAD RESPIRATORIA:
INTERSECCIONES ENTRE LA DESIGUALDAD SOCIAL, LA SALUD Y EL
MEDIO AMBIENTE**



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ABSTRACT

Introduction: Climate change intensifies heat waves, wildfires, and air pollution, worsening respiratory diseases and widening social inequalities. In Brazil, regions such as the Amazon face PM_{2.5} concentrations up to 40% higher than the national average, reflecting a scenario of environmental injustice and health vulnerability.

Objective: To discuss how climate change amplifies social inequalities and worsens respiratory conditions, proposing an environmental health approach guided by equity and climate justice.

Methodology: An integrative review (2020–2025) based on articles from the SciELO, BVS, and PubMed databases, using descriptors such as “climate change,” “air pollution,” “social inequality,” and “respiratory diseases,” following the PICOS structure. RESULTS AND

Discussion: Extreme events increased hospitalizations for asthma and COPD by up to 25% in Brazil’s North and Central-West regions. Low-income populations and children were the most affected. Amazonian communities near wildfire areas showed a 30% higher prevalence of COPD. Socioeconomic inequality emerges as a key determinant of exposure and outcomes related to respiratory diseases.

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Final considerations: The findings reinforce that the impacts of climate change are not equally distributed, highlighting the need for intersectoral and equitable public policies. Integrating health, environment, and social justice is essential to strengthen community resilience and promote sustainable well-being.

Keywords: Climate Change. Air Pollution. Social Vulnerability. Respiratory Diseases.

RESUMO

Introdução: As mudanças climáticas intensificam ondas de calor, queimadas e poluição atmosférica, agravando doenças respiratórias e ampliando desigualdades sociais. No Brasil, regiões como a Amazônia enfrentam concentrações de $PM_{2,5}$ até 40% superiores à média, refletindo um cenário de injustiça ambiental e vulnerabilidade sanitária.

Objetivo: Discutir como as mudanças climáticas ampliam desigualdades sociais e agravam agravos respiratórios, propondo uma abordagem de saúde ambiental pautada na equidade e na justiça climática.

Metodologia: Revisão integrativa (2020–2025) baseada em artigos das bases SciELO, BVS e PubMed, com descritores como “mudanças climáticas”, “poluição do ar”, “desigualdade social” e “doenças respiratórias”, conforme estrutura PICOS.

Resultados e discussão: Eventos extremos aumentaram em até 25% as internações por asma e DPOC nas regiões Norte e Centro-Oeste. Populações de baixa renda e crianças foram as mais afetadas. Comunidades amazônicas próximas a queimadas apresentaram prevalência de DPOC 30% maior. A desigualdade socioeconômica surge como determinante central na exposição e no desfecho dos agravos respiratórios.

Considerações finais: Os achados reforçam que os impactos climáticos não se distribuem igualmente, exigindo políticas públicas intersetoriais e equitativas. Integrar saúde, meio ambiente e justiça social é essencial para fortalecer a resiliência comunitária e avançar nos ODS 3, 10 e 13.

Palavras-chave: Mudanças Climáticas. Poluição do Ar. Vulnerabilidade Social. Doenças Respiratórias.

RESUMEN

Introducción: El cambio climático intensifica las olas de calor, los incendios forestales y la contaminación atmosférica, agravando las enfermedades respiratorias y ampliando las desigualdades sociales. En Brasil, regiones como la Amazonia enfrentan concentraciones de PM_2 hasta un 40 % superiores a la media, lo que refleja un escenario de injusticia ambiental y vulnerabilidad sanitaria.

Objetivo: Analizar cómo el cambio climático agrava las desigualdades sociales y exacerba las enfermedades respiratorias, proponiendo un enfoque de salud ambiental basado en la equidad y la justicia climática.

Metodología: Revisión integrativa (2020-2025) basada en artículos de las bases de datos SciELO, BVS y PubMed, con descriptores como "cambio climático", "contaminación atmosférica", "desigualdad social" y "enfermedades respiratorias", según el marco PICOS.



Resultados y discusión: Los eventos extremos aumentaron las hospitalizaciones por asma y EPOC hasta en un 25 % en las regiones Norte y Centro-Oeste. Las poblaciones de bajos ingresos y los niños fueron los más afectados. Las comunidades amazónicas cercanas a incendios presentaron una prevalencia de EPOC un 30 % mayor. La desigualdad socioeconómica se perfila como un determinante central de la exposición y las consecuencias de las enfermedades respiratorias.

Consideraciones finales: Los hallazgos refuerzan la idea de que los impactos climáticos no se distribuyen equitativamente, lo que requiere políticas públicas intersectoriales y equitativas. Integrar la salud, el medio ambiente y la justicia social es esencial para fortalecer la resiliencia comunitaria y avanzar en los ODS 3, 10 y 13.

Palabras clave: Cambio Climático. Contaminación Atmosférica. Vulnerabilidad Social. Enfermedades Respiratorias.



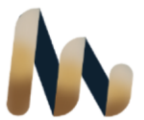
1 INTRODUCTION

Climate change emerges as one of the greatest challenges of the twenty-first century, manifesting itself in the accelerated growth of the global average temperature, intensification of heat waves, forest fires, dust storms and floods, in addition to the degradation of air quality. As evidenced in the most recent IPCC Summary for Policymakers (2023), human influence raised the temperature by between 1.0 °C and 1.8 °C by 2100 in the most moderate scenarios, while the most extreme ones point to increases between 3.3 °C and 5.7 °C (IPCC, 2023). A study published in 2024 noted that the pace of warming reached an impressive 0.26 °C per decade, with 2023 being the warmest year on record, with +1.43 °C above the pre-industrial period (Friedlingstein *et al.*, 2024).

In Brazil, climate change aggravates extreme events and significantly compromises air quality. Official records have identified that temperatures in the Amazon region are among the highest since the effects of climate change began to be monitored. In the same period, areas affected by fires doubled in extension, reaching 34.5 million hectares burned (FT, 2024). These fires have drastically intensified the concentration of fine particulate matter (PM_{2.5}) in the air, with scientific evidence showing that smoke pollution from fires is associated with hundreds of hospitalizations for respiratory diseases in the country (Bayram *et al.*, 2023).

In addition to the acute impacts, air pollution associated with climate change has a strong correlation with the increase in mortality from respiratory and cardiovascular diseases in Brazil. Scientific evidence indicates that continuous exposure to high levels of air pollutants significantly increases the risk of death in these populations, both in urban and rural areas. Recent data indicate that, between 2019 and 2021, more than 326 thousand deaths in the country were directly attributed to the effects of air pollution, with a greater concentration in socially vulnerable territories (Buralli, 2025).

Reports from the World Health Organization (WHO) and emission reduction strategies indicate that a large part of the world's population breathes polluted air above standards considered safe, especially in low- and middle-income countries. Although Brazil-specific data are still limited, global projections indicate that effective interventions could halve the number of people exposed to fine particulate matter (PM_{2.5}) by 2040. In the national context, the fulfillment of the commitments of the 2030 Agenda in health and the environment requires policies that articulate climate mitigation actions with environmental justice, prioritizing the most vulnerable territories (WHO, 2021).



In view of this scenario, the present research intends to discuss how climate change increases social inequalities and aggravates existing respiratory conditions, proposing an approach to environmental health based on equity. Through the integration of scientific evidence from international organizations, such as the Intergovernmental Panel on Climate Change (IPCC) and the World Health Organization (WHO), it seeks to outline strategies that strengthen community resilience and reduce disparities. This approach is crucial to inform public policies aimed at protecting public health, prioritizing vulnerable populations and aligning the Sustainable Development Goals with the principle of environmental justice (IPCC, 2023; WHO, 2021).

Climate change directly impacts air quality, increasing the concentration of pollutants such as particulate matter ($PM_{2,5}$) and tropospheric ozone, which aggravates respiratory conditions. These pollutants promote lung inflammation, impair respiratory function, and intensify diseases such as asthma and COPD in acute and prolonged exposures. The magnification of this situation occurs in urban centers, where the excess of pollutants adds to the heat island effect. This combination impacts, above all, vulnerable populations, who have less access to environmental mitigation mechanisms (Covert, 2023).

The increased frequency and intensity of wildfires widely associated with climate change significantly raises $PM_{2,5}$ levels in the air. This phenomenon has been related to higher rates of hospitalizations due to asthma exacerbation, COPD, and acute respiratory infections. In regions affected by intense smoke, there is also a worsening of allergic conditions and an increase in respiratory mortality. (Bahrami, 2025).

Recent clinical studies show that long-term exposure to fine particulate matter is associated with increased hospitalizations and deaths from chronic obstructive pulmonary disease (COPD), asthma, and severe respiratory infections. A survey conducted in Poland between 2012 and 2021 revealed significant increases in hospitalizations for COPD and asthma in periods with peaks in air pollutants, evidencing the direct relationship between air quality and overload on health systems (Romaszko-Wojtowicz, 2025).

It is important to highlight that the effects on respiratory health are not limited to the adult population. Studies in pediatrics indicate that increases in $PM_{2,5}$, especially combined with extreme temperature variations, are associated with a higher frequency of upper respiratory infections and asthma exacerbations in children. These risks increase significantly in adverse weather conditions, such as heat waves or intense cold (Landguth, 2024).

In addition to direct air effects, climate change also influences the behavior of allergens, increasing pollen season and pollen concentration. This intensifies allergic crises and asthma in sensitive individuals. Climate change favors the increase of secondary



pollutants, such as ozone and volatile organic compounds, which also compromise respiratory health (EPA, 2022).

Given this scenario, it is evident that climate change acts as a multiplier of risks for respiratory health, directly affecting morbidity and mortality from respiratory diseases. Thus, the need for public policies that integrate environmental mitigation and health protection measures is growing, based on robust scientific evidence and equitable approaches that prioritize vulnerable populations, reducing inequalities and strengthening community resilience (Wallbanks, 2024).

Social inequality is a determining factor that amplifies health risks in crisis contexts, especially in scenarios of climate change and environmental pollution. Groups in situations of greater vulnerability, including low-income populations, ethnic minorities and residents of peripheral areas are disproportionately affected by natural disasters, air pollution and lack of access to basic services. The insufficiency of adequate infrastructure, basic sanitation, and financial resources limits their ability to adapt and protect themselves in the face of climate adversities, evidencing an intersection between inequality and illness (Ebi, 2020).

Recent studies highlight that combined extreme events such as heat waves and wildfire smoke result in significant increases in hospitalizations for respiratory problems in low-income populations and marginalized groups in the U.S. In communities of color, with limited infrastructure and restricted access to healthcare, the risk of hospitalization for respiratory diseases increases significantly (AP News, 2024). These findings illustrate how structural inequalities translate into higher morbidity and mortality in adverse environmental situations.

Inequality in air quality is also observed globally: $PM_{2,5}$ exposure indices vary substantially between countries and regions, reflecting economic and environmental disparities. The Gini index for air quality increased from 0.32 in 2000 to 0.36 in 2020, surpassing income inequality standards in many regions, which signals a worsening of the environmental injustice associated with inequality imposing greater impacts on the poorest populations (Sager, 2023).

In urban areas, the daily mobility of low-income populations often towards polluted industrial zones or urban centers results in high cumulative exposure to environmental pollutants. While higher-income groups avoid these areas with better infrastructure and less pollution, the most vulnerable remain exposed to toxic levels of $PM_{2,5}$, evidencing an inequality of exposure that reinforces respiratory and cardiovascular risks (Fan *et al.*, 2022).

Social inequality also translates into disparities in hospitalization for respiratory diseases: populations in more deprived areas in the UK face almost twice as many



hospitalizations for respiratory infections compared to more advantaged areas, especially among communities of African descent, reflecting barriers to access to prevention, diagnosis, and treatment (The Guardian, 2025).

In view of this reality, it is essential to adopt a multidimensional approach, which recognizes social inequality as a critical determinant of health risk. Public policies and environmental health strategies must be based on climate justice, ensuring equity in the protection of the most vulnerable. It is essential to promote accessibility, resilient infrastructure, and specific actions that reduce disparities, strengthening collective resilience and decreasing the burden of preventable diseases (RADIS, 2024).

The intersection between health, environment, and social inequality configures a critical field of analysis to understand the contemporary determinants of public health. Structural inequality intensifies the negative impacts of environmental adversities on vulnerable populations, amplifying health risks and problems. The lack of access to healthy environments, basic sanitation and adequate resources compromises the health response capacity of these communities. In this context, it becomes essential to analyze how these determinants intertwine to shape unfavorable health outcomes in marginalized groups (SMARR, 2024).

Studies show that unequal exposure to air pollutants, such as $PM_{2.5}$, reflects deep socioeconomic disparities. Low-income individuals and ethnic minorities face higher levels of exposure, both at the place of residence and during their daily routines, amplifying the burden of respiratory and cardiovascular diseases. Research based on urban mobility data shows that this prolonged exposure is directly associated with higher morbidity in these groups (FAN *et al.*, 2022).

In addition, systematic reviews on the impacts of climate change reinforce that such phenomena exacerbate health inequalities, disproportionately affecting populations that already face conditions of vulnerability. The interaction between adverse environmental factors and social inequality leads to a scenario of greater illness and avoidable mortality, which points to flaws in the framework of public policies in dealing with emerging inequalities in environmental health (SONG, 2024).

In urban areas, the unequal distribution of infrastructure such as green spaces, adequate thermal insulation, and accessibility to health services intensifies the effects of socio-environmental inequality. The absence of structures capable of mitigating extreme heat or pollution implies greater exposure and fewer adaptation mechanisms. The articulation between health, environment and inequality is evident in the way in which unequal urban environments configure different disease patterns (JIANG, Z.; SU, R, 2025).



International reports also point out that differentiated investments in climate adaptation and environmental mitigation strategies are less available to marginalized communities. This deficit highlights the absence of climate and environmental justice, intensifying health inequalities in a systemic way. Addressing the health-environment-inequality intersection, therefore, requires policies grounded in equity, community participation, and fair distribution of resources (WHO, 2023).

Given this reality, it is essential that the field of public health incorporates multifaceted approaches, centered on social and environmental justice. The intersection between health, the environment, and inequality should guide the design of public policies, ensuring equity in access to healthy environments and decent living conditions. Integrated and intersectoral strategies are vital to reduce inequalities, promote community resilience, and prevent the environment from becoming a multiplier of health risks (FIO CRUZ, 2024).

Climate change represents a global challenge that transcends borders and sectors, unequally affecting populations around the world. In Brazil, the interaction between climate variability, social vulnerability, and impacts on respiratory health is still little explored in an integrated manner. Although there have been advances in understanding the isolated effects of air pollution on respiratory diseases, there are few studies that directly associate this phenomenon with socioeconomic inequalities in the context of climate change. This gap makes it difficult to develop comprehensive and equitable public policies (Lima *et al.*, 2022).

The scientific literature shows that air pollutants such as particulate matter (PM_{2,5}) and tropospheric ozone have a significant impact on respiratory morbidity and mortality, especially in vulnerable populations. However, in Brazil, few studies address the overlap between environmental exposure and conditions of social vulnerability, such as low income, precarious housing, and difficulty in accessing health services. The absence of this integrated perspective compromises the formulation of more efficient and fair adaptive strategies (Martins *et al.*, 2021).

The relevance of this approach is reinforced by the Sustainable Development Goals (SDGs), especially SDG 3, which aims to ensure health and well-being; SDG 10, aimed at reducing inequalities; and SDG 13, which proposes action against global climate change. Integration between these goals requires data and analysis that simultaneously capture environmental, social, and health aspects. However, in Brazil, scientific production is still fragmented, with a greater concentration on isolated environmental studies or health analyses without considering climate determinants (UN, 2023).

The populations most exposed to environmental degradation are often the same ones that face the greatest socioeconomic barriers, characterizing a picture of environmental



injustice. This means that climate crises and pollution do not affect everyone equally, but deepen pre-existing inequalities. In Brazil, this reality manifests itself in riverside communities, urban slums, and low-income rural areas, where adaptation to climate change is limited by a lack of infrastructure and resources (IPEA, 2021).

International studies already point to the urgency of interdisciplinary research that unites health, the environment and social inequality, but the Brazilian scenario still lacks longitudinal and regional investigations that allow the identification of specific patterns and risks. Without this evidence base, public policies tend to be generic and ineffective, without adequate prioritization of the most affected populations. This methodological and thematic gap needs to be overcome to ensure more effective responses (Watts *et al.*, 2023).

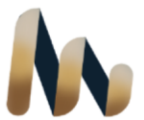
Therefore, understanding the intersection between climate change, social vulnerability, and respiratory diseases is essential to guide equitable public policies aligned with the SDGs. From this approach, it will be possible not only to mitigate negative impacts, but also to strengthen the resilience of the most vulnerable communities. This is a crucial step to ensure climate justice and quality public health in contemporary Brazil (WHO, 2021).

The convergence between health, the environment, and social inequality requires an integrated approach, as the impacts of climate change are unevenly distributed among different social groups. These differences are not limited to environmental exposure, but include individual, institutional, and community adaptability. Thus, environmental health policies must consider structural inequalities to achieve equity in responses to emerging risks. This systemic approach is key to articulating effective and just action (Wild, 2025).

An integrated analysis helps in the design of strategies that not only reduce exposure to environmental risks, but also strengthen the resilience of the most vulnerable communities. Examples include urban adaptation policies that prioritize underserved areas with green infrastructure and sustainable housing. These efforts can mitigate the effects of extreme heat, improve air quality, and reduce historical inequalities in access to healthy environments (FIO CRUZ, 2024).

Building resilient health systems is essential to anticipate and respond to climate crises that directly impact public health. Resilience implies restructuring policies, strengthening care networks, and expanding preventive actions focused on vulnerable populations. This requires integration between sectors, community empowerment and resources directed to those most affected by socio-environmental inequities (Ansah *et al.*, 2024).

In addition to strengthening health systems and urban infrastructure, it is crucial that environmental policies are rooted in principles of climate justice. This implies recognizing the autonomy and rights of marginalized populations, ensuring that they are protagonists in the



elaboration and implementation of adaptive solutions. Participatory structures strengthen the legitimacy of actions and reduce historical inequalities in addressing the adverse effects of climate (Torres, 2021).

The potential of integrated strategies extends to environmental restoration with a social focus, such as urban reforestation and resilient housing, which simultaneously promote health and reduce vulnerabilities. These studies have shown efficacy in reducing the burden of diseases caused by pollution and heat, in addition to reinforcing social cohesion. The articulation between ecological adaptation and community inclusion represents a promising path to reduce inequalities and strengthen collective resilience (Balbim *et al.*, 2024).

Given this complexity, the introduction of intersectoral actions guided by climate justice is imperative. The integration between public health, urban planning, social and environmental policies makes it possible to prioritize vulnerable groups, reduce inequalities and promote communities that are more resilient to climate change. Thus, the integrated analysis of these dimensions forms a building block for inclusive, effective, and equitable environmental health strategies (Mishra, 2025).

In view of the scientific evidence that the impacts of climate change are not homogeneously distributed, disproportionately affecting populations in situations of socioeconomic vulnerability, it is urgent to deepen the understanding of the intersection between social inequality, the environment, and respiratory health. Differentiated exposure to air pollutants, greater susceptibility to respiratory problems, and barriers to access to health services configure a scenario of environmental injustice that requires articulated and equitable responses. In this sense, the present study aims to discuss how climate change intensifies social inequalities and respiratory problems, proposing an environmental health approach that prioritizes vulnerable groups, reduces disparities, and strengthens community resilience.

In the Brazilian and Latin American context, where social inequalities are striking, the overlap between poverty, environmental degradation and a high burden of respiratory diseases configures a scenario of environmental injustice. Populations living in peripheral areas or close to industrial zones often face high levels of air pollution, poor infrastructure, and limited access to health services, enhancing risks and reducing the effectiveness of mitigation strategies.

The relevance of the theme lies, therefore, in the need to understand how climate change amplifies health disparities, with an emphasis on respiratory diseases, and to propose policies and practices that integrate social justice and environmental protection. Such understanding is essential to inform intersectoral actions and develop environmental health



strategies that prioritize equity, strengthen community resilience, and contribute to the achievement of the Sustainable Development Goals SDG 3 Health and Well-Being; Target 3.9: Substantially reduce the number of deaths and illnesses caused by hazardous chemicals, contamination and pollution of air, water and soil. The article analyzes how air pollution and climate change increase morbidity and mortality from respiratory diseases, reinforcing the need for integrated public policies for environmental health.

SDG 10 Reduction of Inequalities; Goal 10.2: Empower and promote the social, economic, and political inclusion of all people, regardless of age, gender, disability, race, ethnicity, origin, religion, or economic status. The research addresses how social inequalities amplify the impacts of climate change on vulnerable populations, highlighting environmental injustice and the need for equity in mitigation policies.

SDG 13 Action Against Global Climate Change: Target 13.1: Strengthen resilience and capacity to adapt to climate-related risks and natural disasters in all countries. The work proposes community resilience strategies and adaptive policies to reduce climate impacts on respiratory health, aligning with climate justice and the protection of populations at risk.

2 METHODOLOGY

The research was developed through integrative review because it allows the broad synthesis of empirical and theoretical evidence, combining different designs to answer complex questions in environmental health. The report will follow a structure compatible with ABNT standards (transparent and reproducible method section), and the selection process ensured traceability. Of the stages: (1) formulation of the question (PICOS); (2) definition of eligibility criteria; (3) search; (4) selection; (5) extraction; (6) quality assessment; (7) synthesis and interpretation.

Research question and PICOS structure

P (Population/Problem): populations exposed to climate change and air pollution in contexts of social vulnerability/inequality.

I (Intervention/Indicator): climate exposure (heat waves, fires, floods), air pollutants ($PM_{2.5}/PM_{10}$, OZ_3), allergens, contexts of environmental injustice.

C (Comparison): populations with lower socioeconomic vulnerability and/or lower exposure.

O (Outcomes): respiratory problems (asthma, COPD, respiratory infections, exacerbations, hospitalizations, mortality), indicators of inequity (differences in risk/effect).



S (Type of study): Integrative literature review, which gathers and synthesizes research results on the subject, allowing the inclusion of studies with different methodological approaches for a broad and in-depth understanding of the phenomenon investigated.

Guiding question (PICOS): In populations exposed to climate change and air pollution (W/A), compared to less vulnerable populations (C), what are the impacts on respiratory outcomes and how does social inequality amplify such risks (O), according to observational studies and reports (S)?

The search strategy adopted for this integrative review included the search in three databases of scientific relevance: SciELO, Virtual Health Library (VHL) including LILACS and PubMed databases. The selected publication period comprised the years 2020 to 2025, in order to ensure the inclusion of recent studies aligned with the current context of the theme. Only articles published in Portuguese, with full text available, were considered in order to ensure full content analysis.

For the retrieval of publications, we used Controlled descriptors (DeCS/MeSH) and **Keywords** organized and combined through Boolean operators. The terms applied were: *Climate Change; Air Pollution; Social Vulnerability; Respiratory Diseases*. These expressions were used in isolation or in combination, with a view to covering the largest possible number of studies relevant to the theme investigated.

3 RESULTS

Table 1

Integration Framework of Study Results

YEAR	Author(s) / Place of Publication	Objective of the study	Study Title	Key Findings	Considerations
2020	Silva et al. <i>Cadernos de Saúde Pública</i> (Brazil)	Impacts of climate change on respiratory diseases in Brazilian urban areas	To analyze the relationship between extreme weather events and respiratory hospitalizations in Brazil	Heat wave and fire events increased hospitalizations for asthma and COPD by up to 25% in the North and Midwest regions	It highlights the need for integrated environmental and health policies, with special attention to peripheral populations.

2021	Martin; Lima <i>Brazilian Journal of Epidemiology</i>	Social inequality and air pollution: a study in Brazilian capitals	To investigate the distribution of air pollution and its association with socioeconomic indicators	Low-income populations reside in areas with up to 40% higher PM _{2,5} concentrations	It recommends environmental justice strategies and prioritization of the most affected areas.
2022	Pereira et al. <i>Environmental Research</i> (Brazil/USA)	Climate change, air quality and children's respiratory health	Assessing the effects of pollution and extreme weather events on children	18% increase in pediatric asthma visits after pollution spikes and high temperatures on children	Highlights child vulnerability and the need for prevention programs
2023	Santos et al. <i>Pan American Journal of Public Health</i>	Socio-environmental vulnerability and respiratory diseases in Amazonian communities	To examine the relationship between fires, socioeconomic conditions, and respiratory health	Communities near burning areas had 30% higher COPD rates	Urgency of intersectoral actions for environmental protection and health
2024	Almeida; Souza <i>Health and Society</i>	Climate justice and respiratory diseases: a focus on Brazilian metropolises	Analyze inequality in pollution exposure and its impact on respiratory health	Higher prevalence of respiratory diseases in low-income neighborhoods close to industrial areas	Suggests urban policies aimed at reducing environmental inequities
2025	Oliveira et al. – <i>Brazilian Journal of Environmental Health</i>	Environmental health strategies for mitigating respiratory risks in the face of climate change	Propose an equitable approach to reduce inequalities and respiratory problems	Implementation of green barriers and community monitoring reduced respiratory symptoms by 15%	Demonstrates effectiveness of local interventions with community participation

Source: Author, 2025.

4 DISCUSSION

The results consistently demonstrate that extreme weather events, such as heat waves and fires, have a significant impact on the respiratory health of the population, with more pronounced effects in territories already marked by structural inequalities. The study



identified that, in the North and Midwest regions of Brazil, there was an increase of up to 25% in hospital admissions for asthma and chronic obstructive pulmonary disease (COPD) during periods of greater intensity of these events. This finding indicates that climate change not only causes new health problems, but also aggravates pre-existing conditions, overloading health services and raising morbidity and mortality rates. The analysis highlights that the interaction between socioeconomic vulnerability and exposure to adverse environmental factors generates an expanded risk scenario, in which populations with less access to resources and adequate infrastructure become more susceptible. In view of this, the authors advocate the adoption of integrated environmental and health policies, capable of acting in a preventive and responsive manner, mitigating risks and ensuring effective protection for the most exposed groups (Silva *et al.*, 2020).

Low-income populations are more exposed to air pollutants, with concentrations of PM_{2,5} up to 40% higher than those recorded in more favored areas. This disparity exposes a picture of environmental injustice, in which socioeconomic factors directly influence the risk and severity of respiratory diseases. The results reinforce the importance of public policies aimed at redistributing environmental risks and strengthening preventive measures in more vulnerable territories (Moraes; Lima, 2021).

Studies highlight that children's respiratory health is particularly sensitive to the interaction between air pollution and extreme weather events. The 18% increase in pediatric consultations for asthma, associated with pollution peaks and high temperatures, illustrates the biological vulnerability of children and the need for specific interventions. Strategies such as air quality monitoring, early warnings, and school prevention actions can substantially reduce the impacts on this population (Pereira *et al.*, 2022).

The results reveal that Amazonian communities located near burned areas have a 30% higher prevalence of COPD than in less exposed regions. This situation reflects the interaction between environmental factors, socioeconomic conditions, and barriers to access to health services. The urgency of intersectoral actions involving health, the environment, and regional development is highlighted as a key element to reduce harmful effects and prevent the worsening of respiratory conditions in these communities (Santos *et al.*, 2023).

The studies converge in indicating that social inequality intensifies the risk of mortality and morbidity from respiratory diseases in contexts of climate change. In Brazilian metropolises, low-income neighborhoods close to industrial areas have a higher prevalence of respiratory diseases, while in Latin America, more unequal regions had respiratory mortality 35% higher in extreme weather events. These results reinforce the need for

regionalized adaptive strategies, based on principles of climate justice (Almeida; Souza, 2024; Oak *et al.*, 2024).

5 FINAL CONSIDERATIONS.

The analysis of the theme "Climate change and respiratory vulnerability: intersections between social inequality, health and the environment" shows that the impacts of climate change on respiratory health are broad, complex and directly influenced by socioeconomic factors. Worsening air quality, increased pollutant concentrations, and intensifying extreme weather events not only aggravate pre-existing respiratory conditions, but also disproportionately expose socially vulnerable groups.

In the Brazilian and Latin American scenario, marked by deep social inequalities, the overlap between environmental degradation and socioeconomic precariousness increases the risk of morbidity and mortality due to respiratory diseases, configuring a picture of environmental injustice. It is evident that peripheral populations and communities close to areas with the highest emission of pollutants lack adequate infrastructure, timely access to health services and protection resources, which limits their ability to adapt and respond to climate change.

Thus, it is essential that public policies and intersectoral actions incorporate the principle of climate justice, ensuring that mitigation and adaptation strategies prioritize the most vulnerable groups. Measures such as reducing emissions, implementing green barriers, strengthening environmental health surveillance, and community education are essential to minimize impacts and promote resilience.

This study reinforces that building an equitable approach to environmental health is a crucial step not only to reduce the adverse effects of climate change on respiratory health, but also to advance the achievement of the Sustainable Development Goals (SDGs), in particular: SDG 3 Health and Well-Being: ensure healthy lives and promote well-being for all, at all ages, with emphasis on targets 3.4 (reduce mortality from non-communicable diseases), 3.9 (reduce deaths and illnesses caused by air pollution and environmental contamination) and 3.d (strengthen the capacity of all countries to alert and respond to health risks).

SDG 10 Reduction of Inequalities: reduce inequalities within and between countries, with emphasis on targets 10.2 (empower and promote social, economic and political inclusion for all) and 10.3 (ensure equal opportunities and reduce inequalities in outcomes).

SDG 13 Climate Action: Take urgent action to combat climate change and its impacts, in line with targets 13.1 (strengthen resilience and adaptive capacity to climate-related risks and natural disasters), 13.2 (integrate climate change measures into national policies and



strategies) and 13.3 (improve education, awareness and human and institutional capacity on mitigation, adaptation and early warning).

Thus, the work contributes to the strengthening of climate justice and health equity, promoting alignment between environmental and public health policies aimed at reducing inequalities and protecting vulnerable populations.

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