Assessing municipal Climate Action Plans through a health lens: the case of the City of Rio de Janeiro

Avaliando Planos de Ação Climática municipais por uma lente de saúde: caso da cidade do Rio de Janeiro

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ABSTRACT

Climate change is a complex global challenge that requires collaboration across multiple scientific disciplines. In urban areas, its effects are more intense due to several factors, such as high population density, building materials, and transportation emissions. Climate Action Plans (CAPs) are the core documents guiding climate-related strategies and initiatives in urban areas. This article analyses the Climate Action Plan of Rio de Janeiro City (CAP_RJC) to assess how it addresses human health. The methodology employs a Content Analysis guided by the approach Urbanism Favourable to Health developed by EHESP France, which is based on Urban Health Determinants. The results indicate that CAP_RJC addresses several determinants of the Urbanism Favourable to Health approach; however, there remains an opportunity to improve vulnerability assessments at the local level.

Keywords: Urban. Adaptation. Climate change. Planning. Health determinants.

RESUMO

As mudanças climáticas representam um desafio global complexo que exige a colaboração entre diversas disciplinas científicas. Nas áreas urbanas, seus efeitos são mais intensos devido a vários

fatores, como alta densidade populacional, materiais de construção e emissões do transporte. O Plano de Ação Climática (PAC) é o documento central que orienta as estratégias e iniciativas relacionadas ao clima em áreas urbanas. Este artigo analisa o Plano de Ação Climática da Cidade do Rio de Janeiro (PAC_RJC) para avaliar como ele aborda a saúde humana. A metodologia emprega uma Análise de Conteúdo guiada pela abordagem Urbanismo Favorável à Saúde, desenvolvida pela EHESP França, que se baseia nos Determinantes Urbanos da Saúde. Os resultados indicam que o PAC_RJC discorre sobre diversos determinantes da abordagem Urbanismo Favorável à Saúde; no entanto, ainda há espaço para aprimorar as avaliações de vulnerabilidade em nível local.

Palavras-chave: *Urbano. Adaptação. Mudanças climáticas. Planejamento. Determinantes de saúde.*

1 INTRODUCTION

Cities demand major attention to the topic of Climate Change (CC), not only in academic research but also in the development of mitigation and adaptation policies at the local level. However, many authors (Hoeben *et al.*, 2023; Sheehan *et al.*, 2022) argue that health is still a less visible dimension in climate change efforts. Additionally, there is limited research on the adaptive capacity of Public Health (Burton, 2015). According to Fagliano and Diex-Roux (2018), climate change is the largest global health challenge of the current century. The authors state that, even though urban areas pose challenges for addressing health consequences, they also offer many possibilities. The Pan American Health Organisation (PAHO) emphasised the development of the PAHO Regional and Global Plan in 2008, to ensure that Public Health is the central axis of the response to Climate Change (Paho, 2009).

The Climate Action Plan (CAP) serves as the central document outlining actions to mitigate and adapt to greenhouse gas (GHG) emissions across various governmental and economic sectors. The urban health components of adaptation policies can prepare municipalities for climate change, mitigate its adverse effects, and enhance the benefits of available technologies and management solutions. According to a recent World Health Organisation (WHO, 2021) report, based on a survey across multiple countries, there has been an increase in the inclusion of health issues in CAPs. However, the level of health inclusion remains inconsistent. Sanches *et al.* (2020) note that the health sector often adopts siloed approaches to address climate change. There is a clear need for an integrated approach that connects health systems with other sectors, such as water and sanitation, transportation, and housing. Turner *et al.* (2023) indicate that while all European Union countries have national adaptation policies, the implementation of health considerations is uneven and often undervalued. Reinwald *et al.* (2024) found that inadequate consideration of exposure and vulnerability hampers effective adaptation planning. Furthermore, some researchers point out a lack of research on adaptation and mitigation in low- and middle-income countries (Jabakhanji *et al.*, 2022).

In fact, cities are more vulnerable to climate events and extreme weather than rural areas. Therefore, the urban population is increasingly susceptible to health problems. In this sense, urban adaptation is critical, particularly in low and middle-income (LMI countries) where urbanisation occurs very fast without adequate planning and infrastructure. The vulnerable population will be more impacted, and inequality is a central issue in LMI countries and must be adequately considered in urban climate plans.

Although numerous mitigation and adaptation programs have been developed in various cities, a clear methodology for analysing the health impacts of these strategies in urban contexts, particularly in developing countries, is lacking. Public health researchers and practitioners typically employ a determinant-based model when promoting intersectoral collaboration to improve health in urban environments (Vlhahov *et al.*, 2007). The fundamental premise is that sectors responsible for social determinants should integrate health considerations into their research and policymaking (Kim *et al.*, 2023).

Rio de Janeiro City (RJC) has sought to create this synergy, producing reports and plans on climate change with input from various municipal management sectors, academia, and civil society. Understanding the social, urban, and economic determinants and conditions is a "sine qua non" condition for municipalities to carry out adequate climate action.

In this study, we analyse the Climate Action Plan of Rio de Janeiro City (CAP_RJC) to understand how human health is addressed. The methodology employs a Content Analysis based on human health criteria of the Urbanism Favourable à la Santé – UFS approach developed by the School of Public Health in France (EHESP), which is grounded in health determinants (Roue-Le Gall *et al.*, 2014).

2 URBAN CLIMATE ACTION PLANS

Global emissions attributed to urban areas increased by 25 GtCO2-eq, to 29 GtCO2-eq in 2020, representing about 62% of total emissions and 67% of the global share (IPCC, 2022). This rise is associated with urban population growth and higher per capita consumption, a trend that is expected to continue, with projections indicating that 70% of the world's population will live in cities by 2050 (UNDP, 2024).

Greenhouse gas (GHG) emissions vary significantly among cities in developed regions, with notable differences in per capita emissions (Kennedy *et al.*, 2009). The Fifth Assessment Report of the Intergovernmental Panel on Climate Change defines adaptation as "the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities" (IPCC, 2014). Adaptation plans aim to reduce the adverse effects of climate change and enhance resilience to its impacts (Unep, 2023; WHO, 2021).

Health considerations are increasingly addressed in a structured manner in the recent IPCC report AR6 (IPCC, 2022), building on earlier analyses by Rosenweig *et al.* (2018) and other reports. According to a special report from the World Health Organisation on climate change and health (WHO, 2021), health adaptation assessments should encompass national evaluations of climate impacts, vulnerabilities, and adaptation strategies for health, along with national and city-level climate change risk assessments.

Cities are actively engaging in both climate change mitigation and adaptation efforts. However, adaptation presents numerous challenges, often affecting multiple sectors over an extended timeframe. Focusing on public health within transformational adaptation goals can help protect the health of individuals, particularly those most vulnerable to climate change effects (WHO, 2021). The Lancet Countdown on Health and Climate Change in Europe, a collaborative initiative led by The Lancet, suggests that climate plans should prioritise health, well-being, and equity, which could represent a significant public health opportunity in this century (van Daalen *et al.*, 2022).

A review of academic literature on adaptation in Low and Middle-Income Countries (LMIC) by Scheelbeck *et al.* (2021) revealed that evaluations of adaptation strategies for gradual climate change are limited, with most studies focusing solely on extreme weather events. At the national level, Paz-Soldan *et al.* (2023) assessed the Climate Action Plans (CAPs) of 12 South American countries regarding their consideration of climate change impacts on health. Their findings indicated a lack of connection to health issues and insufficient detailed information to assist policymakers in implementing effective actions. Aboagye and Sharifi (2023) drew similar conclusions when they examined 287 CAPs from cities around the world and noted a lack of inclusivity, integration, and transparency. Additionally, Farkas *et al.* (2024) conducted a content analysis of climate plans from Slovenian cities and found that interventions often neglect the most vulnerable groups affected by heat waves.

Currently, the development of knowledge regarding effective CAPs is progressing slowly and still requires more effort. Olazabal and Gopegui (2021) argue that there is significant room for improvement in

adaptation planning in major global cities, highlighting the importance of how adaptation is integrated into local planning processes and of governments' prior experience. If this complexity is overlooked in a CAP, it can lead to maladaptation. Maladaptation refers to ineffective planning that fails to adequately address vulnerability, stemming from a misunderstanding of what vulnerability entails. It often results from poorly constructed plans based on limited or incorrect assumptions. Scheelbeek *et al.* (2021) found that instances of maladaptation in low- and middle-income countries were primarily associated with increasing inequalities and unforeseen adverse effects. Identifying vulnerabilities is critical and may be one of the most challenging aspects of CAPs (Juhola *et al.*, 2016).

3 DETERMINANTS OF URBAN HEALTH

Many urban health issues arise from inadequate urban conditions, poverty, limited access to urban infrastructure and services, weak social cohesion, and inequalities (Barton; Tsourou, 2004; Vlahov *et al.*, 2007). Urban Health Determinants are life and work conditions that affect health and can be used to elaborate and evaluate policies (Friche *et al.*, 2015; Vlahov, 2014). The intricate interplay of urban factors affecting health necessitates methodological approaches that incorporate the perspectives of various stakeholders to identify ways to mitigate health problems and enhance positive health outcomes. Chapman *et al.* (2016) assert that climate change in urban areas should be viewed as an analysis of a complex system, requiring an integrated approach that aligns urban, health, and environmental objectives.

The UN-Habitat and WHO (2020) guide for integrating health into urban planning suggests utilising traditional health sector elements, including disease prevention (e.g., waterborne diseases), health promotion (e.g., physical activity and mobility), and ecological public health (e.g., local food systems and resilience strategies). This guide emphasises that health considerations should permeate all planning phases: diagnosing problems through ex-ante evidence, formulating interventions via health impact assessments, implementing interventions through engagement and inclusion, and finally, monitoring and evaluating outcomes through health outcome reports. The guide advocates an integrated approach that connects the social determinants of health with the Sustainable Development Goals (SDGs) and influences decision-makers across various urban sectors, underscoring the role of public health professionals in planning for the health and well-being of populations.

Roue-Le Gall *et al.* (2014) from the School of Public Health at Rennes - EHESP in France present a systemic approach to the social determinants of health in urban environments, aiming to promote the dissemination and standardisation of concepts related to urban health determinants. Their guide is divided into two sections: the first addresses concepts linking urbanism and health, while the second provides a practical guide to analysing the health impacts of urban projects.

This study for CAP will apply the first section, which outlines governance criteria essential for an urban health approach: health, participation, inequality, vulnerability, sensitivity, adaptive capacity, susceptibility, social inclusion, coordination, risk, and intersectoral action. The guide includes an assessment matrix with Urban Health Determinants (UHD), such as health behaviour, social cohesion and equity, local democracy, accessibility of urban services and facilities, economic development and employment, habitat, urban spaces, security, nature, Climate Change Adaptation, outdoor air pollution, soil, water, waste management, noise and electromagnetic fields.

The Guide highlights two mechanisms by which environmental exposures can contribute to social health inequities: vulnerability differential (exposures affect populations with precarious health situations more intensely) and exposure differential (underprivileged populations may have higher levels of exposure). Interventions should maximise protective factors and reduce risk factors, always prioritising the most vulnerable populations. The authors also note that these mechanisms may

overlap, underscoring the need for an integrated analysis of the various determinants that influence health in the urban environment.

Finally, the UFS guide suggests five axes of action that should summarise the planned urban intervention: reduction of pollutants and other harmful agents; promotion of healthy individual behaviours; change the social environment to foster social cohesion, the well-being of inhabitants and the mitigation of health inequities between different groups and populations, considering the antagonisms and possible synergies in the implementation of urban projects.

4 METHODOLOGY

The objective of this study is to assess the Climate Action Plans of Rio de Janeiro City (CAP_RJC) through a health lens. To carry out this assessment, a Content Analysis is applied to analyse the plans. Given the characteristics of the research object, the study chose a manifesto-type analysis method. Manifesto-type analysis is more superficial and seeks to identify what was said (Bengtsson, 2016). The structure adopted in this study has three phases, based on Bardin (1997): 1) pre-analysis, 2) exploration of the material and 3) treatment of results, inference, and interpretation.

The choice for Rio de Janeiro City was due to its complexity. Also, RJC is prone to extreme weather events and CC disasters, which mainly affect a high percentage of the vulnerable population living in informal settlements without adequate infrastructure.

4.1 PRE-ANALYSIS

In pre-analysis or de-contextualisation, researchers initially analyse the documents before extracting the most important excerpts. The study prepares a list of codes to perform the analysis. The methodological design of this study, which seeks to identify the health content of CAP, suggests that the codes are deductive. The researchers create them in advance, in line with the study's objective and the UFS criteria described in section 3.

As a federative republic, Brazil has a three-level government: National, State, and Municipal, in which the lower levels must follow the legislation and regulations of the upper levels. The municipal CAP plan must follow the national and Rio de Janeiro State CAPs. This way, to analyse municipal plans, we must also consider State and National regulations. This study will analyse the following plans:

- National Climate Action Plan – NCAP2016 (MMA, 2016)
- Adaptation Plan of Rio de Janeiro State – RJS2018 (ERJ, 2018)
- Sustainable Development and Climate Action Plan of Rio de Janeiro City – RJC2021 (PMRJ, 2021a).
- National Adaptation Plans: cities sectoral plan – NAP Cities 2026 (Brasil, 2025).

4.2 EXPLORATION OF THE MATERIAL

In the material exploration or re-contextualisation phase, the analysis produces an analytical description that may include the following items: coding and classification. In this phase, the analysis defines categories and identifies registration units, followed by frequency counting.

4.3 INTERPRETATION

In this phase, the interpretation or re-contextualisation of the excerpts defined in the previous item takes place. Researchers can make inferences and categorise data based on homogenisation criteria and other criteria. A categorisation can occur within rules or criteria: mutual exclusion, homogeneity, relevance, and objectivity. At this stage, researchers must compare inferences with the context in which the research object occurs. For this study, the researchers created keywords/codes categories based on the UFS approach (Roue-Le Gall *et al.*, 2014) to draw inferences about the inclusion of health in the plans.

5 RESULTS

In Brazil, Rio de Janeiro State has the highest level of population exposed to the adverse effects and risks of climate change, compared with the other 26 states (MMA, 2016). Its capital, Rio de Janeiro City, is the second most populous city in Brazil, with a population of 6,2 million in 2022 (IBGE, 2024) in an area slightly superior to 1.300 sq. km. According to the GHG inventory for Rio de Janeiro City, 31% of the city's emissions are attributable to transport. Solid waste accounts for 9%, and industrial energy consumption accounts for 11% (PMRJ, 2015).

The municipality of Rio de Janeiro has approximately 1,018 slums, which concentrate 23% of the city's population and still present inadequate conditions for water supply, sanitation, waste disposal, and storm drainage (PMRJ, 2022a). Bortz *et al.* (2015) created the Urban Health Inequalities index for the city of Rio de Janeiro, which indicated that over the period of 2002-2010, the ratio of inequality extremes declined. Yet, the social distinction between poor and rich areas remained.

5.1 RE-ANALYSIS

The Brazilian National Adaptation Plan – NCAP2016 (MMA, 2016) provides guidance for initiatives to manage and reduce the risks of climate change's adverse impacts in the long term. It was elaborated with the participation of several institutions, including the health sector, and has specific chapters dedicated to strategies for health, infrastructure and cities. One of the city's strategy guidelines is to improve urban planning models. NCAP2016 recognises the limitations of the water and sanitation infrastructure that lead to population vulnerability and ensures the establishment of intersectoral actions to reduce population exposure.

At the state level, the Adaptation Plan of Rio de Janeiro State – RJS2018 (ERJ, 2018) focus on impacts such as floods, landslides, and vector-borne diseases. It also presents adaptation actions for roads, seashores, and green areas. The State Environmental Agency developed the plan with the support of the academia. It states that the region is highly vulnerable to climate disasters. RJS2018 underscores the region's high hydrological stress and the need for adaptation. Regarding human health, it focuses on chronic diseases (cardio and respiratory) and infectious vector-borne diseases. It also indicates that the actual vulnerability of the poor population due to inadequate urban infrastructure and services increases the impacts of climate change.

Academia, several institutions, and urban international networks supported the elaboration of the Sustainability Development and Climate Action Plan of Rio de Janeiro City – RJC2021 (PMRJ, 2021a), with community participation. It presents interventions in five areas linked to one or more SDGs, with 138 goals and 978 actions. It includes four main axes for sustainability actions: green (forests, parks), brown (infrastructure), blue (water, rivers, oceans), and orange (social and economic issues). In addition, its scenarios include short-, medium-, and long-range estimates.

In 2026, the federal government released a comprehensive package of national climate plans comprising three parts: mitigation plans, adaptation plans, and transversal climate plans. The Climate Adaptation plans package has as its first National Adaptation Goal "to increase the resilience of the population, the cities, the territories and infrastructures in response to climate emergency" (Brasil, 2025). One of these national adaptation plans, NAP Cities 2026, is dedicated to cities. This is an extensive document that reinforces the unique characteristics of adaptation in cities, underscoring the need for an intersectoral approach to management.

5.2 EXPLORATION OF THE DOCUMENTS

In the Material Exploration phase, the analysis quantified the codes using the keywords. One of the authors first counted them, a second author later confirmed or rejected this count, and a third author judged the relevance of disagreements between the first two authors. This triangulation minimises potential interpretation errors. The results of the analysis appear according to the categories of the UFS approach (Roue-Le Gall *et al.*, 2014):

5.2.1 URBAN HEALTH GOVERNANCE - UHG

Table 1 presents categorisation counting for criteria based on governance of health in urban environments. Health is an important criterion for the NAP 2016 and RJC 2021 plans, the second-most-cited criterion. There is a similar profile between RJS 2018 and RJC 2016; in both plans, vulnerability was the most cited category.

Table 1 – Categorisation counting for UHG – Urban Health Governance

Governance	*NAP 2016*	*RJS 2018*	*RJC 2021*	*NAP Cities 2026*
Health	116	47	397	24
Participation	27	5	425	23
Inequality	-	1	4	-
Vulnerability	359	97	144	64
Sensitivity	43	3	4	3
Adaptive capacity	42	11	8	5
Susceptibility	28	30	19	-
Social inclusion	1	-	16	1
Coordination	24	3	15	7
Risks	251	110	177	75
Intersectoral	18	1	35	7

Source: The authors

NAP 2016 is the national adaptation plan for the entire country. Not surprisingly, it discusses several aspects of human health that are affected by CC. In doing so, Vulnerability and Risks appear as the most cited criteria. Indeed, these concepts are already common among the stakeholders involved in the climate change debate. And it highlights the importance that national authorities attach to the population's vulnerability to disasters and other climate events. Sensitivity was seldom used, except for NAP 2016. Except in NAP 2016, CC plans did not frequently address Adaptive Capacity, a concept linked to vulnerability.

RJS 2018 discussed the less-frequent concept of Susceptibility, focusing on several areas affected by landslides, drought, and flooding in Rio de Janeiro State. This is also the reason for a higher risk and vulnerability score in RJS 2018.

Healthy behaviour and participation were poorly considered in NAP Cities 2026, while vulnerability and risks remain on top. There is a significant opportunity to develop Health Promotion interventions, which should be vigorously pursued at the city level.

RJC 2021 is a long, detailed document with several chapters covering different SDG goals for the city. It highlights a significant concern regarding popular participation and intersectoral action, which were less emphasised in the other plans. Indeed, it emphasises public participation and the involvement of several institutions. It also proposes actions to promote social inclusion. Health, vulnerability and risks are also highly cited.

5.2.2 URBAN HEALTH DETERMINANTS - UHD

As shown in Table 2, the Climate Change Adaptation category had high scores across the three plans, as expected for climate adaptation plans. Water was also highly cited across all plans, confirming the relevance of this environmental determinant in tropical urban areas. Living environment determinants such as Habitat, Urban Spaces and Security were almost absent in the NAP 2016 and RJS 2018. Still, they were often cited in RJC 2021 and in NAP Cities 2026, reinforcing the urban profile of these plans. Also, we must mention that RJC 2021 presents some actions for Social Cohesion and Equity, a determinant that is also emphasised in NAP Cities 2026.

Table 2 – Categorisation counting for UHD – Urban Health Determinants.

Urban Health Determinants	*NAP 2016*	*RJS 2018*	*RJC 2021*	*NAP Cities 2026*
I - Lifestyles, social and economic structures				
Healthy behaviour	-	-	7	-
Social cohesion and equity	-	4	35	18
Local democracy	-	-	11	1
Urban services and equipments accessibility	3	11	6	89
Economic development employment	42	20	21	3
II - Living environment				
Habitat	16	-	80	64
Urban spaces	2	13	196	16
Security	9	10	93	17
III - Environment and resources				
Nature	155	1	21	14
Climate Change adaptation	561	182	123	192
Outdoor air pollution	10	-	4	-
Water	287	48	197	88
Waste management	15	9	48	27

Urban Health Determinants	NAP 2016	RJS 2018	RJC 2021	NAP Cities 2026
Soils	5	25	72	3
Noise and electromagnetic fields	-	-	-	-

Source: The authors

The plans do not mention some urban health determinants, such as noise and electromagnetic fields. Indeed, some mitigation and adaptation actions could reduce noise. For example, electric cars are quieter than fossil-fuel engines and might reduce human stress from noise. These are co-benefits of CC interventions that should be evaluated and monitored by the plans. Several plans did not cite air pollution, which suggests a lack of association between local air pollution and greenhouse gas impacts. Moreover, the plans presented few explicit actions on Healthy Behaviour. The absence of some of these determinants shows the need to improve debate on adaptation in cities.

5.3 INTERPRETATION OF THE CAPS

The municipal plan RJC2021 has demonstrated a more consistent integration of urban health determinants than the national and state climate plans. It emphasises determinants such as Habitat, Urban Spaces, Social Cohesion, and Equity. Although these plans seldom addressed concepts such as Susceptibility, Inequality and Adaptive Capacity, CAPs included several urban health determinants.

The RJC2021 presents several programs and actions for the next decades. The study selected one of those programs to analyse, due to its urban and social relevance. The so-called Reviver Program - Requalification Plan for the Centre of Rio de Janeiro, created through Municipal Decree No. 48348/2021 (PMRJ, 2021b), was developed to re-qualify the RJC downtown area, as its business area occupation rate decreased significantly after the Covid-19 pandemic. This program aimed to comprehensively requalify the area and bring the population back downtown. The plan also comprised several other actions for public spaces, with the final goal of downtown revitalisation and reduction of urban sprawl. As happened in many other cities worldwide, the goal is to renovate commercial buildings and to build new residential units. It is worth mentioning that this is the oldest part of the town. Some of the actual inhabitants are descendants of the Africans who were enslaved for three centuries.

According to the decree, the district's regulations align with the City of Rio de Janeiro's Sustainable Development and Climate Action Plan (RJC2021). It involved several municipal offices, such as Transport and Mobility, Historical Heritage, Waste Management, Environment, Energy, Water & Sanitation services, Drainage, Park and Forest, Social Service, Urbanism, Security, Planning, and so on.

One of the subprojects of the Reviver Program is the Low Greenhouse Gas Emission District – LGGED (item P.L.L.10), which aims to radically transform the mobility profile of the downtown area, considering the existing infrastructure of subways, trams, and other modes. It includes several actions, such as restrictions on fossil fuels, fostering walking and cycling with the expansion of routes, and so on. The program will also support Health Promotion activities. C40 cities and other institutions also support these actions. Annex I presents a summary of the Reviver Project assessment considering the UFS criteria. Other actions include an intersectoral plan for the homeless population, a program for waste pickers of recycling materials, cultural programs for creative economics, fire prevention for historical buildings, greening of parks and so on.

Table 3 – Analysis of an urban health action according UFS (Roue-Le Gall *et al.*, 2014): low emissions zone in downtown Rio de Janeiro city.

Axe 1 – control of emissions, annoyance reduction and its cumulative effects	This is the main goal of the Low Emissions Zone (LZE) of the Reviver Project. The project will discourage fossil fuel vehicles and expand cycling routes. This measure will reduce not only GHG emissions but also local atmospheric pollution and noise.
Axe 2 – promotion of healthy behaviour and physical activity of the population.	Active mobility is a priority for the project. Plans for the expansion of cycling routes. Also, actions for green areas.
Axe 3 – contribution to the improvement of the economy and social environment.	A new economic profile will emerge with services and stores for family consumption. Cultural and Green spaces will also be a gathering opportunity for social cohesion.
Axe 4 – reduction of social and environmental health inequalities.	Some actions focus on the reduction of inequalities, including affordable housing and reductions in transportation costs for poor communities, students, and retired people.
Axe 5 – management of antagonisms and fostering of synergies.	New habits, such as walking instead of driving, and the lack of car parking, will result in conflicts. The project must pursue population engagement to avoid confrontation. Health and climate literacy can make an important contribution.

Source: The authors

According to the concept of Urbanism Favourable to Health – UFS, the final analysis of urban projects should be conducted along five axes, as shown in Table 3. All five axes have applicability to the Reviver Project. The main goal of the Low Emission Zone is GHG mitigation (axis 1). Health Promotion (axe 2) is a Public Health strategy that has the potential to change harmful habits and promote healthier behaviour. The Reviver Project mentions economic development, focusing on reducing inequality (axes 3 and 4), though the sources of investment are unclear. Finally, axis 5 will demand a strong political effort and citizen participation.

6 DISCUSSION

This paper applies an urban health determinant approach to evaluate how Climate Action Plans of Rio de Janeiro City address human health. Results show that these plans have evolved to a more comprehensive and inclusive design that considers multiple aspects of health in accordance with selected criteria. The criteria suggested by the Urban Health Determinants (Roue-Le Gall *et al.*, 2014) served as the basis for the analysis, providing a robust approach to guide urban planners and other stakeholders in integrating a human health perspective into climate planning and action. Furthermore, it can support decision makers in promoting an effective transformation of the RJC downtown area. Moreover, other cities that are fostering climate adaptation in urban environments can apply this approach.

RJC2021 has several mentions of Urban Spaces, Security, Social Cohesion, and Habitat, suggesting a broader vision that includes urban determinants not directly related to human health. Reviver Project is one of the actions planned in RJC2021 that aims to requalify the old downtown area. It presents an opportunity to emphasise the importance of integrating health into CC plans. It includes a Low Emissions Zone that could have a significant impact on GHG mitigation and pollution reduction, potentially creating a better environment for individuals with allergies, cardiovascular and respiratory diseases. The project includes actions for the homeless population living in the downtown area and for the social inclusion of waste pickers, reflecting its concern for vulnerable populations. Reviver represents a paradigm shift in lifestyle: from car-based transportation to active mobility, a 15-minute city. However, the project does not specify the necessary adaptations for vulnerable populations such as children, older people, and people with disabilities.

The plans include some of the health determinants but neglect or rarely mention others. There is an opportunity to integrate health into CAPs to enhance citizens' quality of life. This way, all actions will

take into account the vulnerability and adaptive capacity of populations. Therefore, CAPs must align with Master Plans, Building Codes, and, most importantly, Municipal Health Plans.

For each urban health determinant, the plan must identify populations' vulnerabilities and focus actions on them. The plan must address specific issues so the support does not break down. To avoid this, the plan should organise intersectoral group meetings throughout the project with popular participation. The plan must also develop and analyse vulnerability indicators for every climate action. Territorial inequalities demand local analysis and reinforce the need to identify specific vulnerabilities at the local level, since informal settlements and low-income neighbourhoods are more vulnerable (Muñoz-Pizza *et al.*, 2023). Local actors should implement climate vulnerability assessment at the local level (Kim; Jung, 2023).

Given the need for integrated action to address environmental crises, the three branches of government (executive, legislative and judiciary) in Brazil signed a pact with the objectives of promoting sustainable cities, reducing the environmental impact of productive activities, and reducing greenhouse gas emissions in all sectors of the economy, among other topics (Brasil, 2023).

More recently, in June 2024, Brazil issued a new law establishing Guidelines for the Elaboration of Adaptation Plans (Brasil, 2024). The law reinforces the coordination of adaptation investments based on people's vulnerability and the need to articulate among federal, state, local, and socioeconomic sectors, while considering popular participation. It emphasises the need to harmonise methodologies for risk and vulnerability analysis, and for the identification and prioritisation of adaptation measures. Lobo *et al.* (2023) also suggested such integration to develop the knowledge of urban science and climate. Also, the guideline suggests that urban infrastructure and the right to the city should be a priority for climate change adaptation plans that pursue inequality reduction, aligned with other sector policies and urban plans.

In this sense, a strong connection must be established between CAPs and other urban plans, such as the Municipal Master plan, Transportation plan, Health plan, and others, to ensure effective coordination with the agendas of social, political, and economic stakeholders, as suggested by NAP Cities 2026. Monitoring and evaluating adaptation actions can generate valuable data and insights for society, using indicators such as those outlined in Agenda 2030. This can also help identify and reduce existing inequalities while preventing the emergence of new ones that could result from climate interventions.

The Rio de Janeiro Municipal Health Plan (PMRJ, 2022b) highlights the importance of social determinants and the need to combat health inequalities. It considers actions connected to the RJC2021 adaptation plan, such as reducing road injury fatalities. Also, it has Health Promotion actions, such as physical activity programs, in 202 health units.

Notably, institutions such as ICLEI (Local Government for Sustainability), C40 (Global Network of Mayors), and local academic institutions supported the development of the municipal plan RJC2021. These networks have been playing an important role in encouraging cities to adopt climate policies and in guiding their implementation (Rashidi; Patt, 2018).

In this application of Content Analysis, we used predefined categories based on Urbanism Favourable to Health, an approach developed at EHESP - France, which established urban health criteria following a three-year project that included several intersectoral sectors. Nonetheless, we acknowledge that our methodology has limitations. These criteria might be more or less appropriate for a developing country in a tropical region, a phenomenon denominated validation in Content Analysis (Dalla Valle; Ferreira, 2025). But the UFS approach is being applied in other countries, such as the Republic of Georgia in Eastern Europe, so we are confident that it is not restricted to France.

Reliability is also a common limitation in Content Analysis. Therefore, the reliability of a Content Analysis is high when other researchers obtain similar results using the same procedures and coding for the same material (Sampaio; Lycarião, 2018). In this article, the three authors counted the categories separately after semantic training and consensus interpretation, thereby performing triangulation.

Another limitation is that the frequency criterion does not always reflect a topic's importance. (Dalla Valle; Ferreira, 2025). Indeed, in our analysis, we do not compare the absolute frequencies of the CAPs, but rather the evolution of the criteria over time and the relevance of each criterion for each CAP.

Overall, the methodology used in this article can help stakeholders develop and elaborate municipal plans that consider urban health issues. This is an innovative approach to a city-level climate plan and should be applied and improved in other cities and contexts. One of the characteristics of AC is that it reduces the complexity of a collection of texts; systematisation by urban health criteria can refine extensive documents, allowing for shorter analysis time. Also, it should be noted that the methodology is replicable in other cities within diverse urban contexts.

7 CONCLUSION

This article applied the Urbanism Favourable to Health (UFS) approach to analyse how the Climate Action Plans of Rio de Janeiro City integrate health. EHESP – France developed the UFS approach based on the health determinants and health promotion principles of governance, health literacy, adequate environments, and popular participation. Overall, the climate plans under analysis address several issues recommended by UFS. The approach could be applied more comprehensively across all adaptation actions. This action would minimise the risk of maladaptation while protecting vulnerable populations.

In fact, Climate Action Plans should be tailored to the specific needs of local contexts. Furthermore, capacity building for the planning team should include developing a health-oriented vision. For the same tasks, health professionals need to receive training to recognise and respond to the potential health impacts of climate change. The UFS approach can serve as a valuable guide in the design and evaluation of climate action plans, helping to reduce climate impacts, promote benefits, and enhance the quality of human life in urban areas.

Based on our findings, we recommend adopting a health determinants approach in the development and evaluation of climate action plans. This can help minimise health risks and prevent maladaptation, improving population health. We also suggest further research to identify climate change vulnerability at a very local level. In this way, planned actions can reduce climate change impacts and enhance knowledge of the urban determinants of health in the context of climate change, in line with the PAHO statement that "Public Health must be the central axis of the response to climate change".

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

MGA: Conceptualisation, Methodology, Data Curation - Writing - Original draft preparation. VSS: Visualisation, Investigation, Data curation. LBEV: Data curation - Writing - Reviewing and Editing.

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STATEMENT ON THE USE OF ARTIFICIAL INTELLIGENCE

The authors declare that no generative AI or AI-assisted technologies were used in the creation, writing, or editing of this manuscript.

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