Urban Pulse: Identifying Resilience Solutions at the Intersection of Climate, Health and Equity

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Resilient Cities Network (R-Cities)

Registered offices:
Mexico City
Durango 195- Piso 7 Sur
Roma Norte, 06700
Mexico City

New York City
28 Liberty Street, LISC Floor 34
NY, NY 10005

Rotterdam
Korte Hoogstraat 31
3011 GK, Rotterdam
The Netherlands

Singapore
#06-01, 182 Cecil St,
Frasers Tower,
Singapore 069547

Program description:
Urban Pulse

Contact:
Karl Astbury: kastbury@resilientcitiesnetwork.org
Jeannette Ickovics: Jeannette.Ickovics@yale.edu

Authors:
Yale School of Public Health:

Jeannette Ickovics

Hannah James

Nandini Sinha

Abby Ong

R-Cities:

Karl Astbury

Malcolm Campbell

Design/layout:
Razvan Zamfira (R-Cities)

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NEW YORK, SEPTEMBER 2024

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Preface

In the face of rapid urbanization and escalating climate challenges, cities stand at the critical juncture of environmental and public health priorities. Climate change is not just an environmental issue, it is a public health crisis. The increasing frequency and intensity of extreme weather events, rising temperatures, and shifting disease patterns are intensifying health challenges and worsening disparities in health outcomes, particularly in cities. Cities are home to more than half of the global population and contribute approximately 75% of global emissions. Cities are primary drivers of climate change, and often most vulnerable to its impacts. Cities are also places of innovation, and places where new ideas can be implemented most effectively for social change.

Urban resilience is defined as the capacity of a city's systems, businesses, institutions, communities, and individuals to survive, adapt, and grow despite the acute shocks and chronic stresses they experience. Acute shocks are sudden, intense events that threaten a community, such as earthquakes, hurricanes, and terrorist attacks. The impact of acute shocks is exacerbated by chronic stresses that weaken the fabric of a community over time, such as recurrent flooding, high unemployment, inadequate social safety nets, and inequitable distribution of services and resources.

Climate change threatens urban resilience and has direct and indirect effects on public health. Health impacts of climate change – including heat-related illnesses, increased spread of vector-borne diseases, more severe weather events, and adverse impacts on mental health – disproportionately affect marginalized and vulnerable communities. Addressing these impacts requires a comprehensive approach.

Urban Pulse is a transdisciplinary collaboration between the Resilient Cities Network and Yale University, supported by The Rockefeller Foundation, that highlights the complex intersections between climate, health, and equity in cities. Focused on findings from surveys and stakeholder interviews with nearly 200 city leaders, this report provides a comprehensive overview of the current landscape, successful interventions, and actionable recommendations for cities, stakeholders, and funders. We underscore the urgency for action and highlight innovative solutions, providing a roadmap for cities to enhance resilience, safeguard public health, and promote social equity.

CONTENTS

Executive Summary

Climate change directly and indirectly impacts health, exacerbating heat-related illnesses, aggravating cardiovascular and respiratory diseases, and increasing risk of vector-borne diseases while also adversely impacting mental health and well-being.[1] Recognizing these challenges, we launched Urban Pulse to place health and equity at the center of climate action and drive policymakers and community stakeholders to work together to address these critical issues.

Causes of climate change are global; however, health impacts are inherently local.[2] Facing acute climate shocks and chronic stresses, cities are first-line responders for public health preparedness, surveillance and response.[3] Given sluggish national-level action, many city governments have initiated climate action to address population density, heat island effects, limited green space, coastal proximity, and aging infrastructure.

One-half of the world's population live in cities, increasing to 70% by 2050. In low- and middle-income (LMIC) countries the pace of urbanization is even faster.[4] Those in concentrated poverty and without access to health and social services are disproportionately vulnerable, resulting in profound inequities. Climate change has profound direct and indirect effects on health and mental health, such as prolonged heatwaves and heat island effects, increased severity of extreme weather events, and rapidly-spreading infectious diseases such as dengue, which are exacerbated in cities.[5 6 7] Nearly 40 Sustainable Development Goal targets are relevant to urban health.[8] Accordingly, cities must be on the frontline to promote health and climate justice.[9] Articulating health advantages of climate action increases public support and informs policymakers' ambition for policy change.[10 11]

This report is part of a broader effort called Urban Pulse—a collaboration between Yale University and the Resilient Cities Network supported by the Rockefeller Foundation to address climate, health and equity, particularly in low- and middle-income countries. Through this scoping grant, we generate actionable knowledge to build urban climate and health resilience, foster civic and institutional engagement, and support evidence-based policies and programs – increasing the capacity of city systems and urban dwellers to thrive.

Key Findings

City Readiness and Priorities for Climate, Health, and Equity: *Synthesis of Survey* Responses

Recognition of Climate Threats to Population Health

Two of three cities identify extreme heat, flooding, and air pollution of "high concern," with impact on health and well-being of city residents.

Inadequate Preparedness

Although 37% of cities have a climate resilience plan, only 23% of cities have a comprehensive plan that concurrently addresses health. Essential resources like early warning systems and health surveillance capabilities are often inadequate for decision-making.

Deficient Municipal Systems

Critical municipal systems such as water and waste management, food systems, health and public health systems infrastructure are generally rated poor – with no discernible differences across city region, size and income.

Lack of Multisectoral Collaboration

Only 20% of cities indicate "strong coordination" between city departments – such as health, environment, transportation, urban planning – essential to forge an integrated response to tackle the many challenges related to climate, health and equity.

Vulnerable Populations

Cities recognize differential impacts of climate on health of citizens, with certain groups disproportionately impacted: Children identified as a priority for most cities.

Zero-Carbon Economies

Nearly 90% of respondents believe that transitioning to a zero-carbon economy will create economic opportunities and benefits for residents.

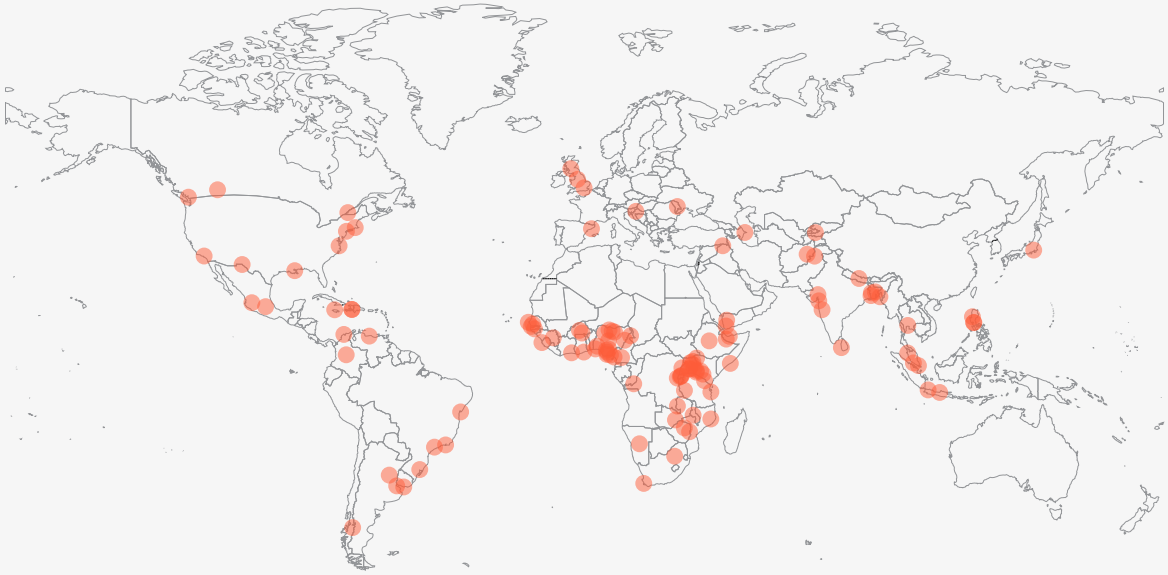
Increased Engagement

Cities report increasing attention and investment from policymakers and community leaders at the sub-national level to prioritize and promote climate, health and equity. They express a strong interest to identify, implement, and amplify solutions.

Garnering Insights: 2024 Urban Pulse Surveys and Stakeholder Interviews

We took a mixed-methods approach to gain deep and broad insights from cities around the world. Surveys were completed by 191 respondents in 118 cities in 52 countries, as illustrated in the map. Respondents included leaders in city governments and civil society (e.g., community-based, non-profit, and private sector organizations). The survey utilized the framework established by the 2023 Lancet Countdown report,[12] emphasizing the critical need for a health-centered response to climate change, including health hazards, adaptation and planning, mitigation actions, economics and finance, and public/political engagement. The Lancet authors specify the need for sub-national level analyses, and we believe that cities are a critical first line of defense. To get a more complete perspective, we asked additional questions related to health systems,[13] data capabilities, and global engagement. Quantitative analyses revealed substantial variation by city region, income, size, and other characteristics. Thematic analyses from open-ended survey questions provided qualitative insight into city solutions already being implemented at the nexus of climate, health, and equity. Finally, we conducted eight key informant interviews, providing further examples of successful initiatives across low- and middle-income countries in Africa, Asia, and Latin America.

FIGURE 1 Participating Cities



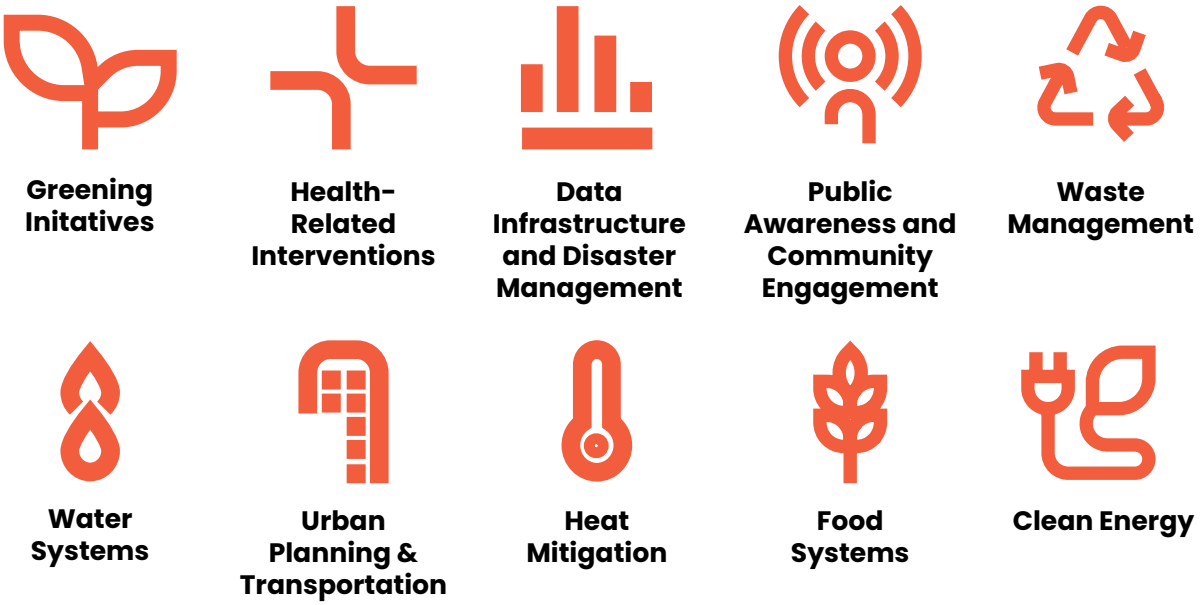
Abidjan, Côte d'Ivoire
Abim District, Karamoja, Uganda
Abuja, Nigeria
Accra, Ghana
Addis Abab, Ethiopia
Ahmedaba, India
Baguio City, Philippines
Baku, Azerbaijan
Bangkok, Thailand
Banjul, Gambia
Barcelona, Spain
Barranquilla, Colombia
Berbera, Somalia
Bogota, Colombia
Bristol, Rhode Island, United States
Buenos Aires, Argentina
Bukavu, Democratic Republic of the Congo
Burkina Faso, Burkina Faso
Busia, Kenya
Calgary, Canada
Cape Town, South Africa
Caracas-Venezuela, Venezuela
Chattogram,Bangladesh
Chișinău, Moldova
Cohyaique, Chile
Colombo, Sri Lanka
Dakar, Senegal
Dar es Salaam, Tanzania
Dhaka, Bangladesh

Dohuk, Iraq
Enugu, Nigeria
Esit Eket, Nigeria
Falmouth, Trelawny, Jamacia
Fergana, Uzbekistan
Fort-portal, Uganda
Freetown, Sierra Leone
Glasgow, United Kingdom
Gon-Boussougou, Burkina Faso
Greater Manchester, United Kingdom
Guinee, Guinea
Port-au-Prince, Haiti
Harare, Zimbabwe
Hargeisa City, Somaliland
Ibadan, Nigeria
Jakarta, Indonesia
Jhenaidah District, Bangladesh
Jigawa state, Nigeria
Johannesburg, South Africa
Juárez, Mexico
Kabul, Afghanistan
Kakuma Refugee camp, Kenya
Kampala, Uganda
Kano, Nigeria
Kaolack, Senegal
Kathmandu, Nepal
Katsina State, Nigeria
Kigali Rwanda
Kinshasa, Democratic Republic of the Congo
Kisii, Kenya
Kisumu, Kenya
Kota Semarang, Indonesia
Lagos, Nigeria
Lilongwe, Malawi
Limbe-Cameroon, Cameroon
Lira City, Uganda
London, United Kingdom
Los Angeles, California, United States
Lusaka, Zambia
Manila, Philippines
Mansa, Zambia
Maroua, Cameroon
Maru, Zamfara State, Nigeria
Melaka, Malaysia
Metropolitan Area of Guadalajara
Mexico City, Mexico
Mogadisho, Somalia
Montevideo, Uruguay
Montreal, Canada
Moshi, Tanzania
Mpanda, Tanzania
Muhanga, Rwanda
Mutare, Zimbabwe
Nairobi, Kenya
Nakuru, Kenya
Nampula, Mozambique
New Orleans, Louisiana, United States
New York, New York, United States
Norfolk, Virginia, United States
Onitsha, Nigeria
Owerri, Nigeria
Penang, Malaysia
Peshawar, Pakistan
Port-au-Prince, Haiti
Port Harcourt, Nigeria
Porto Alegre, Brazil
Pune, India
Quezon City, Philippines
Rio de Janeiro, Brazil
Rulindo, Rwanda
Salvador, Brazil
Sana'a, Yemen
Santa Fe, Argentina
São Paulo, Brazil
Satkhira, Bangladesh
Sédhiou, Senegal
Singapore, Singapore
Soroti City, Uganda
Surat, India
Taiz, Yemen
Tokyo, Japan
Vancouver, Canada
Wakiso, Uganda
Windhoek, Namibia
Yaoundé, Cameroon
Yola, Nigeria
Zagreb, Croatia

City-Level Resilience Solutions: *Thematic Analysis*

While the survey revealed many urban challenges, respondents also shared innovative, city-level initiatives (e.g., programs, policies) already successfully implemented that build climate and health resilience. Thematic analyses from nearly 300 open-ended responses identified solutions in the following 10 areas that have the potential for replication and scale-up.

Climate & Health Solutions – Social, Behavioral and Structural Interventions in Cities



Deeper Insights in Cities in Low- and Middle-Income Countries: *Stakeholder Interviews*

A series of stakeholder interviews were conducted with city leaders in Africa (Addis Ababa, Cape Town, Lagos), Asia (Semarang, Surat), and Latin America (Buenos Aires, Montevideo, Porto Alegre). These provide deeper insights into city-level challenges, opportunities, creative solutions, and aspirations.

Challenges and Opportunities

Primary challenges are inadequate city capacity; neglecting vulnerable groups in climate resilience efforts; misalignment between needs and policies; and inequitable resource distribution. Reliance on short-term fixes, rather than addressing long-term solutions and underlying environmental threats, is a fundamental concern. Opportunities include enhancing city infrastructure, promoting inclusive policies that empower communities, and accountability through transparent public engagement.

COLLECTIVE ACTION FOR A SUSTAINABLE FUTURE

Taking these steps – *beginning with one or many* – will enable cities to build a more resilient, healthy, and equitable future despite the accelerating climate crisis. Continued support and innovative partnerships are essential to address the impacts of climate change on health and to ensure equitable and sustainable solutions in cities. Research results provide a strong foundation from which Resilient Cities Network and Yale University can continue to strengthen our partnership with each other and with the cities engaged in the Urban Pulse initiative. The challenges we face are monumental, but so are the opportunities for transformative change. We must harness our collective strength to protect health, promote equity, and ensure a sustainable future. The time for action is now. Together, we can build cities that are resilient, thriving, and inclusive for all.

RECOMMENDATIONS FOR CITIES: URGENT ACTIONS FOR A RESILIENT FUTURE

Based on research and engagement – enhanced through these surveys and stakeholder interviews – we provide these 10 recommendations for cities to enhance climate and health resilience.

1. **Put health at the heart of urban climate change agenda.** Identify climate shocks and stresses, exposure pathways, and consequent health risks; measure factors that influence vulnerability and adaptive capacity to prioritize resources, especially for vulnerable populations.

2. **Implement health-focused urban adaptation programs and policies.** Adopt comprehensive city strategies to address climate, health and equity concurrently. Plans should be inclusive, data-driven, and community-focused. Adaptation solutions include greening initiatives, vector-borne disease control heat mitigation, and population-based mental health support.

3. **Place prevention and health promotion at the forefront of climate mitigation strategies.** Prioritize investments that will have the biggest impacts on health, such as affordable clean energy and a just transition toward the elimination of fossil fuels; air quality; active transportation like safe walking/cycling routes and zero-emission public transport; food/water/waste management. Recognize that every climate mitigation action is a health action, with important co-benefits.

4. **Redirect financial flows to investments that have climate and health co-benefits.** Invest in green infrastructure, renewable energy, and energy-efficient systems; leverage economic opportunities of transitioning to a zero-carbon economy which will improve outcomes for planetary and human health. Cities must also address the cost of inaction against current climate-health trajectories.

5. **Foster collaborative multi-sector public and political engagement on climate, health and equity.** Leverage strong interest from city leadership to foster inclusive and proactive collaboration across sectors, including government, the scientific community, private-sector stakeholders, the media, and city residents. Organize policy dialogues, participatory planning sessions, and awareness campaigns to amplify climate-health messaging and drive action.

6. **Promote climate resilient & sustainable healthcare initiatives.** Recognize that hospitals and health centers are anchor institutions in cities. City governments should partner with healthcare providers and administrators to promote community health and reduce carbon emissions generated by health facilities. Health systems must be prepared and resourced to withstand and adapt to climate change impacts, ensuring continuity of care.

7. **Enhance data infrastructure and surveillance capabilities.** Integrate climate-health data systems and digitize to assure more timely response; establish early warning mechanisms; and leverage community needs assessments and surveillance to improve preparedness and response to climate-related health risks. Use data to forecast future health impacts that could result from a changing climate to inform long-term strategic decision making in cities.

8. **Foster city-to-city collaborations and knowledge exchange initiatives.** Engage in active partnership with other cities, to share best practices and innovate solutions. Such collaborations create a global network of resilient urban communities committed to addressing common challenges through collective intelligence and mutual support.

9. **Build on cities' successful implementation of programs and policies designed to promote climate and health resilience.** Amplify and scale existing programs while investing in evidence-based innovations that continue to be rigorously monitored for impact. These can be categorized as initiatives for climate adaptation or mitigation and those that create an enabling environment by strengthening fundamental city systems.

10. **CALL TO ACTION - Create groundbreaking strategies to build urban resilience.** City leaders must formulate an ambitious and holistic approach to address the intertwined challenges of climate, health and equity – sparking innovation, multi-sector collaboration, and new market opportunities. Together, we can create robust and sustainable solutions.

RECOMMENDATIONS FOR FUNDERS: DEDICATED FUNDING FOR NEW AND SUSTAINED INITIATIVES

To implement these recommendations, public- and private-sector funding is essential. Health-specific climate action remains severely underfunded with only ~6% of adaptation funding and 0.5% of multilateral climate funding allocated to projects that protect or improve human health.[14] The United Nations Environment Programme estimates that low- and middle-income countries require at least $11 billion in funding per year this decade to adapt to climate and health impacts and to increase the resilience of health systems.[15] Despite this need, only $1 billion was committed for climate and health at COP28, pointing to a gap of at least $10B annually in required funding to support countries in tackling issues at the nexus of climate, health and equity.[16]

1. **Prioritize Funding:** Funders must prioritize and increase investments in projects that integrate climate, health, and equity. This includes driving forward the recommendations outlined in this report, while developing new financing models that prioritize rapid disbursement of funds to countries, cities and communities most vulnerable to the adverse effects of climate change.

2. **Support Capacity Development:** Provide technical assistance to cities, particularly those with limited resources. Conduct feasibility studies, helping cities prepare projects to be bankable and investment ready, and build capacity through equipping city officials with the knowledge and skills needed to develop projects worthy of further investment.

3. **Fund Research and Evaluation:** Support transdisciplinary research in cities that goes beyond documenting known associations between climate and health to intervention and cost-benefit studies that strive to improve planetary and human health. This will ensure that innovations are evidence-based and can be amplified and scaled-up from city to city, and region to region.

COLLECTIVE ACTION FOR A SUSTAINABLE FUTURE

Taking these steps – *beginning with one or many* – will enable cities to build a more resilient, healthy, and equitable future despite the accelerating climate crisis. Continued support and innovative partnerships are essential to address the impacts of climate change on health and to ensure equitable and sustainable solutions in cities. Research results provide a strong foundation from which Resilient Cities Network and Yale University can continue to strengthen our partnership with each other and with the cities engaged in the Urban Pulse initiative. The challenges we face are monumental, but so are the opportunities for transformative change. We must harness our collective strength to protect health, promote equity, and ensure a sustainable future. The time for action is now. Together, we can build cities that are resilient, thriving, and inclusive for all.

Background and Rationale

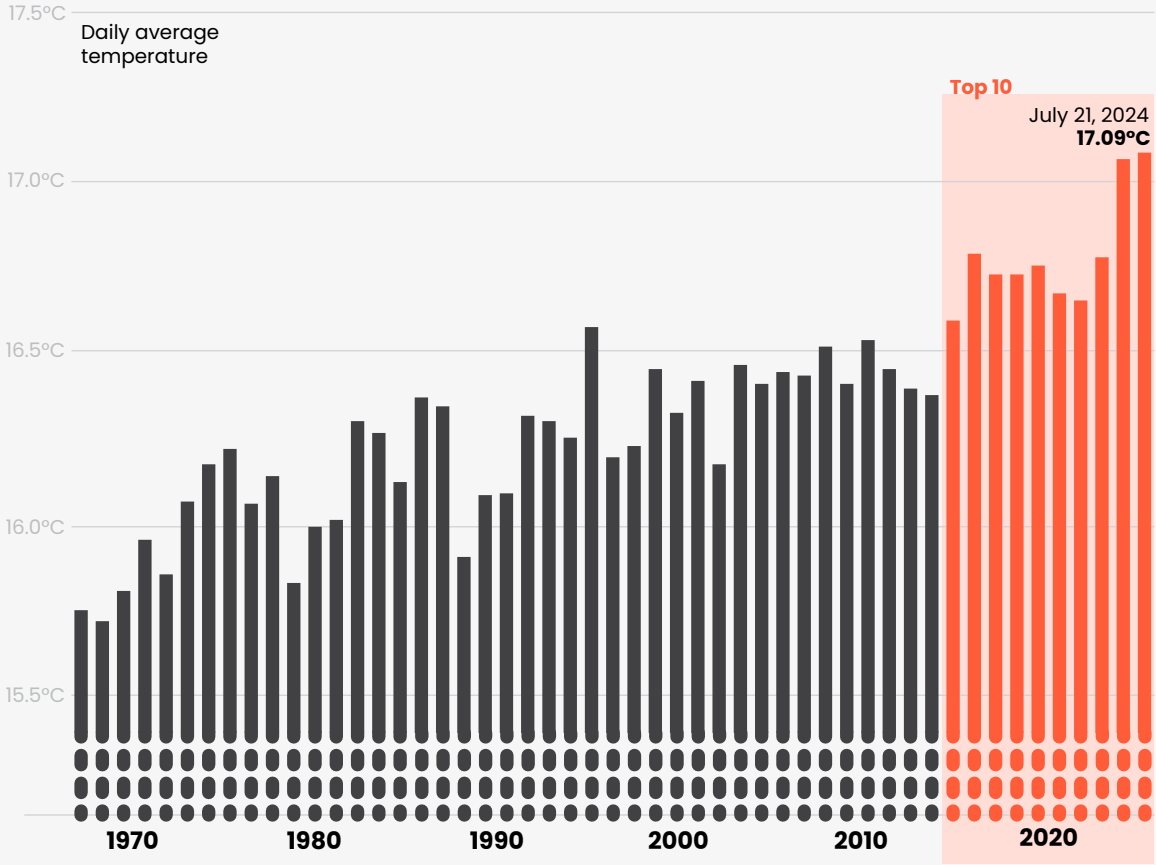
Global temperatures reached new record highs for two consecutive days in July 2024; the past 13 months have been the hottest on record; and the 10 years with the highest annual maximum global-average daily temperatures have been from 2015 through 2024.[17] Climate change is directly contributing to heatwaves, wildfires, droughts, tropical storms, hurricanes, and floods – and these are increasing in scale, frequency, and intensity. The primary cause is our human activities resulting in excess greenhouse emissions through the burning of fossil fuels.[18]

These climate changes have had profound effects on planetary and human health. Warmer air and oceans, more intense droughts and wildfires threaten biodiversity.[19] The US National Institutes of Health (NIH) documents consequent direct and indirect effects on human health primarily due to heat and air pollution. These effects include: heat-related illnesses and deaths; changes in the range of disease-carrying insects (mosquitoes, ticks, fleas) that transmit vector-borne diseases like dengue, West Nile Virus and malaria; allergies and other lung diseases such as asthma; cardiovascular disease; food- and water-borne disease due to increasing flooding and sea level rise that contaminate with harmful bacteria, viruses and chemicals; chronic stress, anxiety, depression and other mental illnesses; and injuries and death due to extreme weather events.[20]

The World Health Organization reports that 3.6 billion people already live in areas highly susceptible to climate change, and that between 2030 to 2050, an excess 250,000 deaths per year will result from climate change-related heat-stress, diarrhea, undernutrition and malaria alone.[21] They estimate direct damage costs to health to be between $2–4 billion per year by 2030. Areas with weak health infrastructure will be least able to cope with these demands, emphasizing the need to support countries – and cities – to reduce health vulnerability to climate change. There is growing consensus regarding the urgency of health as a key priority within the climate change agenda. This was recognized for the first time by the global community at COP28 in December 2023, where there was a Climate and Health Declaration signed by 151 countries, and $1 billion pledged for climate and health action.[22]

FIGURE 2 Highest global average temperatures

The ten highest maximum global-average daily temperatures of the last 50 years have all occured since 2015



Data for 2024 shown up to 21 July 2024 is preliminary. The y-axis does not start at zero.
Data sources: ERA5 / Credit: Copernicus Climate Change Service/ECMWF

Cities: Epicenter of Climate and Health Action

Global health in the age of climate change will increasingly be determined by and in our cities. More than half of the world's population currently lives in cities, with this proportion set to increase to 70% by 2050. Rapid urbanization intensifies the climate emergency, with cities contributing 75% of global emissions while often facing the most severe climate impacts.[23] In these urban areas, those in concentrated poverty and without access to health and social services are disproportionately vulnerable to the effects of climate change, resulting in profound inequities. These challenges are exacerbated in cities in LMICs, where urbanization is occurring at a rapid pace, services are often inequitable or inadequate, and resources are often insufficient. Furthermore, city governance is often siloed, with separate teams addressing health, mental health, disaster recovery, land-use planning, infrastructure, and ecological sustainability. This approach diminishes collective understanding of health impacts of climate and cannot meet compelling societal needs.

As cities become the epicenter of inter-related health, climate, and equity challenges, they must also be on the frontline to promote health and climate justice. Cities around the world are taking action to address the climate and health crisis, and they urgently require tools, knowledge and support.

Urban Pulse: Climate, Health and Equity in Action

Recognizing these risks and challenges, Urban Pulse was designed to generate timely and relevant knowledge for urban climate and health resilience, disseminate insights to inform the public, promote civic and institutional engagement, and support evidence-based

programs and policies. We recognize knowledge gaps and the need for transdisciplinary research and action, local analyses to strengthen preparedness, and strategic policy analyses to guide practical actions. Launched at COP28 in Dubai[24 25] – the first edition of COP with a designated health day – Urban Pulse is led by a transdisciplinary team from the Resilient Cities Network and Yale University with support from The Rockefeller Foundation. Urban Pulse was formed with the explicit goal of putting health and equity at the heart of climate action.

Urban Pulse highlights the complex intersections between climate, health, and equity in cities. By generating research, promoting innovative solutions, facilitating exchange, and highlighting the urgent imperative for action, we aim to provide the support, resources and enabling environment that cities require to build climate and health resilience. The climate crisis is a health crisis. Urban Pulse explicitly addresses the urgency and importance of health action within the broader global climate agenda and catalyzes urban solutions to promote and protect health and to uphold equity in the face of the accelerating climate crisis. A primary goal of Urban Pulse is to cultivate a network that bridges health, climate and equity within the urban resilience ecosystem. This network includes diverse stakeholders from the public and private sectors working collaboratively to fortify cities against climate-related risks while promoting planetary and human health.

About the Partners

Founded in 1701, Yale University is one of the oldest institutions of higher education in the world. Yale is committed to improving the world today and for future generations through outstanding research and scholarship, education, preservation, and practice. Yale educates aspiring leaders worldwide who serve all sectors of society. Urban Pulse is a transdisciplinary collaboration that includes faculty and students from the Yale School of Public Health, Yale School of the Environment, Yale School of Nursing, and Yale Architecture.

The Resilient Cities Network is the world's leading urban resilience network, present in more than 100 cities, more than 40 countries, and six continents, with regional offices in Singapore, New York City, Rotterdam, and Mexico City. It is a city-led non-profit organization that brings together knowledge, practice, partnerships, and funding to empower cities to build a safe, equitable, and sustainable future for all. Its mission is to reduce vulnerability and improve the well-being of urban dwellers around the world.

About this Report

The primary focus of this report is to share results from our mixed-methods research, designed to gain deep and broad insights from cities around the world. We begin with a description of the key findings in three sections based on survey responses, thematic analysis, and stakeholder interviews.

I. City Readiness and Priorities for Climate, Health, and Equity:
Synthesis of Survey Responses

II. Top 10 City-Level Resilience Solutions:
Thematic Analysis

III. Deeper Insights in Cities in Low- and Middle-Income Countries:
Stakeholder Interviews

The quantitative survey responses (Section I) are organized in four parts, describing results based on The Lancet Countdown on Health and Climate Change framework; the World Health Organization Building Blocks of Health Systems; cities' data collection and surveillance capabilities; and their interest in global collaboration and scale-up. A thematic analysis of nearly 300 open-ended responses to the survey identified resilience solutions as well as challenges and opportunities (Section II). And, a series of eight stakeholder interviews were conducted, providing additional insights into how city leaders in select low- and middle-income countries are addressing the intersection of climate, health and equity (Section III).

We provide 10 Recommendations for City Leaders based on our analysis, embedded throughout this report. Three additional recommendations for funders are presented in the conclusions section along with implementation strategies to build a healthier, more equitable, and sustainable urban environment for all.

Key Findings Organized by Mixed-methods Approaches

I. City Readiness and Priorities for Climate, Health, and Equity: *Synthesis of Survey Responses*

Surveys were completed by 191 respondents in 118 cities in 52 countries, from nearly every region in the world (February-April 2024). Recruitment was conducted using a convenience sample of email distribution lists from the Resilient Cities Network, the C40 Cities Climate Leadership Group, and the Climate x Health network. Respondents included city officials, private-sector counterparts, and representatives from community-based and non-profit organizations. When there was more than one survey response from a city, we averaged responses within that city to assure equal representation. Responses were stratified by geographic region, World Bank economic designation, size, coastal designation, Koppen climate index, and other relevant characteristics.

The strengths of our process include a multi-method approach that garners a large amount of information from many city stakeholders. Moreover, we have over-representation of cities from the Global South, providing a unique opportunity to capture the attitudes, behaviors, and cognitions of those often not included in research. Nonetheless, this was a convenience sample, and we expect that those who participated already have an interest in climate, health and equity.

A. Survey Responses based on The Lancet Countdown on Health and Climate Change Framework

We organized the first portion of the survey and these results adapting the five-category framework established by the **2023 Lancet Countdown on Health and Climate Change**, emphasizing the critical need for a health-centered response to climate change:

1. Health hazards, exposures, and impacts
2. Adaptation, planning, and resilience for health
3. Mitigation actions and health co-benefits
4. Economics and finance
5. Public and political engagement with health and climate change

The section below provides an overview of these findings by category and indicator, highlighting some differences by city size, region, income, and Koppen climate index. Subsequent sections provide more details regarding the findings, including key insights and recommendations.

Additional survey questions were also asked (e.g., WHO Health Services Building Blocks, data and surveillance infrastructure, global collaboration and scale up), with results presented thereafter.

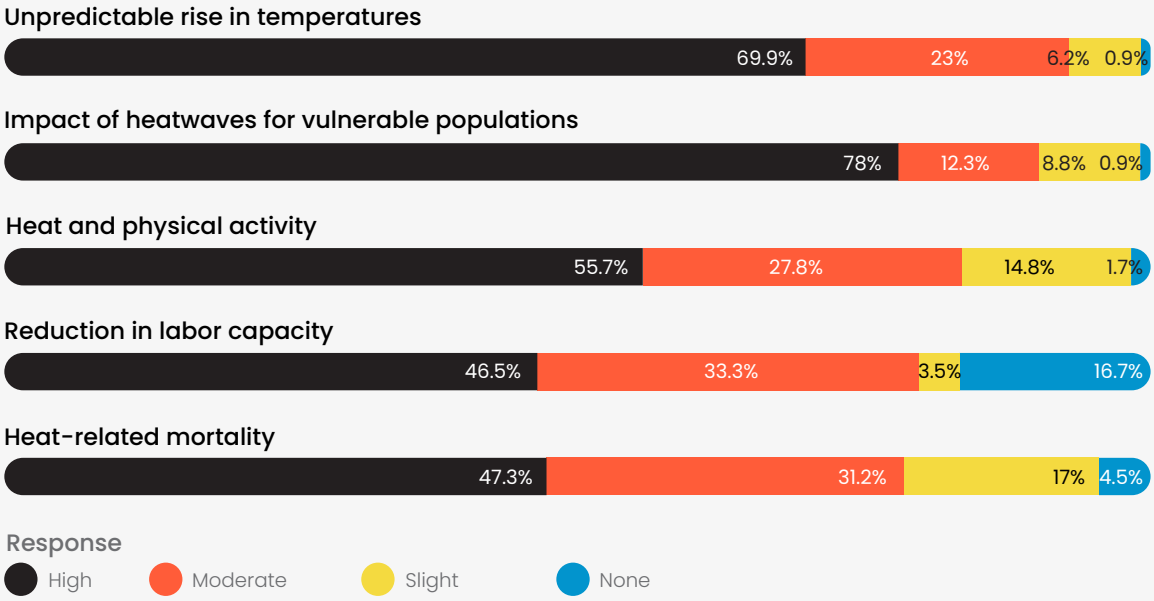
1. HEALTH HAZARDS, EXPOSURES, AND IMPACTS

RECOMMENDATION 1:
Put health at the heart of the urban climate change agenda.

Identify climate shocks and stresses, exposure pathways, and consequent health risks; measure factors that influence vulnerability and adaptive capacity in cities in order to prioritize resources and reduce exposure, especially for vulnerable populations.

Cities recognize profound climate threats from short-term shocks as well as long-term stresses and their impact on the health and mental health of residents. Cities are particularly vulnerable to longer and hotter heatwaves and increasingly disastrous storms, threatening lives, livelihoods, neighborhoods, and businesses. As climate threats continue to rise, health protection and promotion must be prioritized. This first category of indicators focuses on heat, extreme weather events, infectious diseases, and food security.

FIGURE 3 Concerns about Heat and Health



Seventy percent of cities rate unpredictable rise in temperatures of "high concern" [Figure 3]. They are especially concerned about exposure of vulnerable populations to heatwaves. Respondents recognized the increased vulnerability of certain groups, ranging from young children to older adults as well as outdoor laborers, those living in informal settlements, and those who have migrated. Nearly one-half of cities reported high concerns about reduction in labor capacity and heat-related mortality.

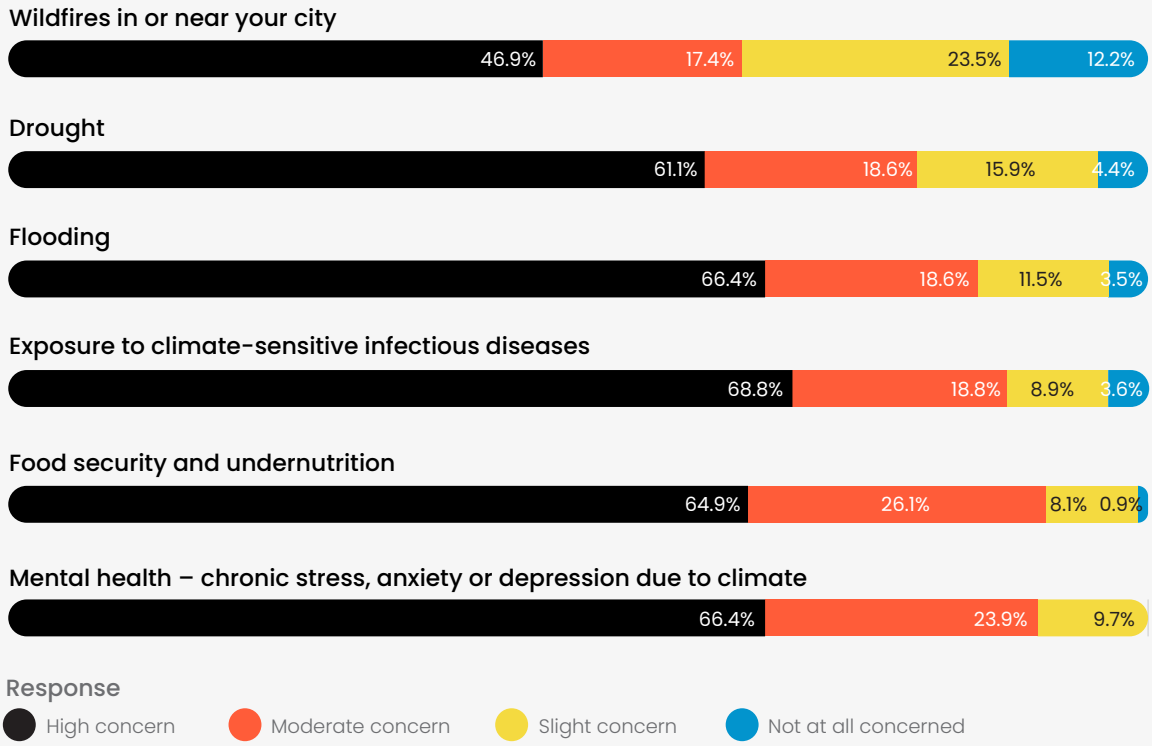
Considering the impact of other extreme weather events, nearly one-half of cities rated wildfires of "high concern. And, 60-70% of cities rated drought, flooding, exposure to climate-sensitive infectious diseases (e.g., dengue, malaria), food security and undernutrition, and mental health of "high concern."

"There is a need to build stakeholders' understanding of climate change and its impact on health and to facilitate the creation of community-based response interventions that are aimed at tackling climate change and its effects on health."*

Survey Respondent

* Illustrative quotes from survey respondents are embedded; a more thorough thematic analysis with city attribution is presented in Section II.

FIGURE 4 Concerns about the Impact of Climate-related Effects on Health



2. ADAPTATION, PLANNING AND RESILIENCE FOR HEALTH

RECOMMENDATION 2:
Implement health-focused urban adaptation programs and policies.

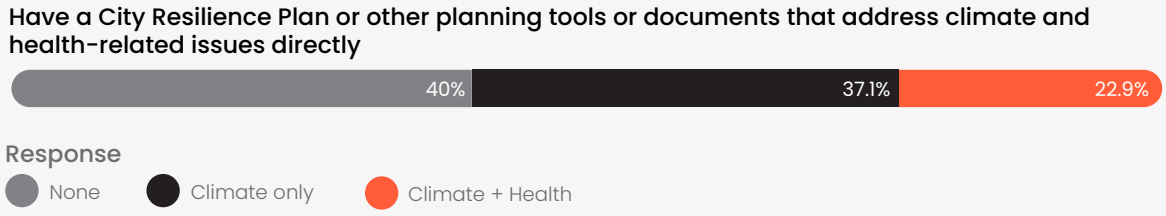
Adopt comprehensive city strategies to address climate, health and equity concurrently. Plans should be inclusive, data-driven, and community-focused. Adaptation solutions include greening initiatives to expand urban green spaces, improve air quality, and enhance climate resilience; vector-borne disease control; heat mitigation efforts; and population-based mental health support.

Public health must be at the center of transformational adaptation targets to ensure that population health is protected, particularly for the most vulnerable. Adaptation strategies aim to minimize the level of harm experienced due to effects of climate change. Even if we were to mitigate future threats, adaptation efforts would still be essential now. This category reflects assessment and planning of health adaptation strategies, enabling conditions, and vulnerabilities.

Despite the many climate and health concerns expressed by respondents, cities are only moderately ready to address these challenges. When asked on a scale of 0% to 100%: How ready is your city to address climate and health challenges? they responded with an average score of 42% ready. Readiness is higher (above the mean) in North America, Latin America and the Caribbean, and Europe and the Middle East; readiness is lower (below the mean) in Asia-Pacific and in Africa.

Sixty percent of cities have a City Resilience Plan or other planning tools/documents that address climate threats; however, of these, only 22.9% have plans that explicitly address health [Figure 5]. These are most often found in large cities; cities in high and upper-middle-income countries; those in Latin America and the Caribbean, Europe and the Middle East, and North America.

FIGURE 5 City Resilience Plan or Other Planning Tools



Respondents generally rate their city systems as “fair” or “poor” – this includes water management, waste management and sanitation, food systems, and healthcare systems [Figure 6]. Few cities have reliable access to early warning systems (30%); climate information (e.g., heat, air quality forecasts, 41.3%); prevention strategies to avert climate-related risks (35.6%); or emergency response plans for acute climate shocks (40.7%) [Figure 7].

FIGURE 6 Evaluation of City Systems

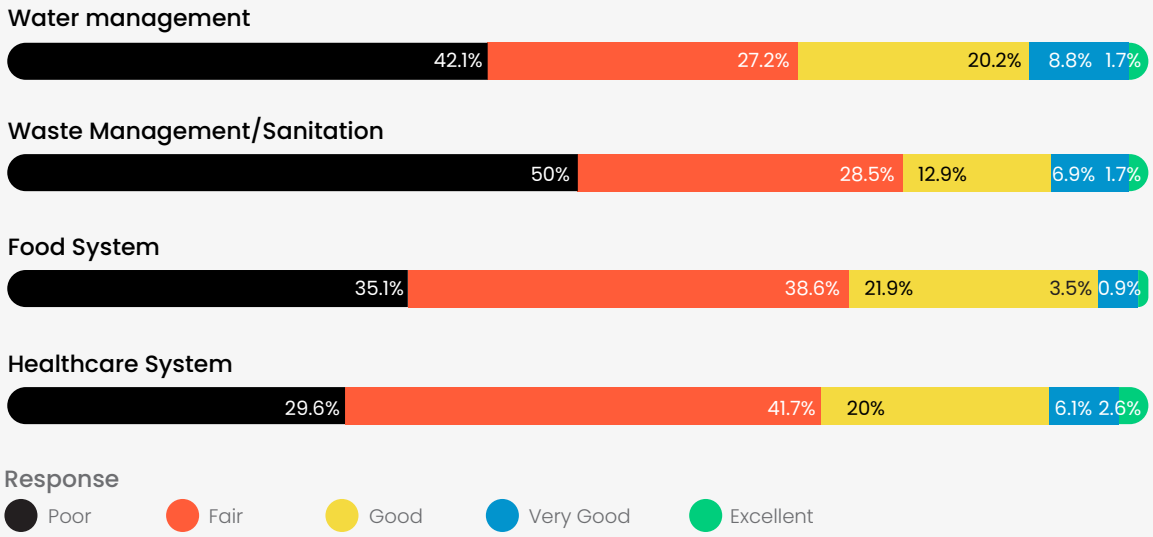
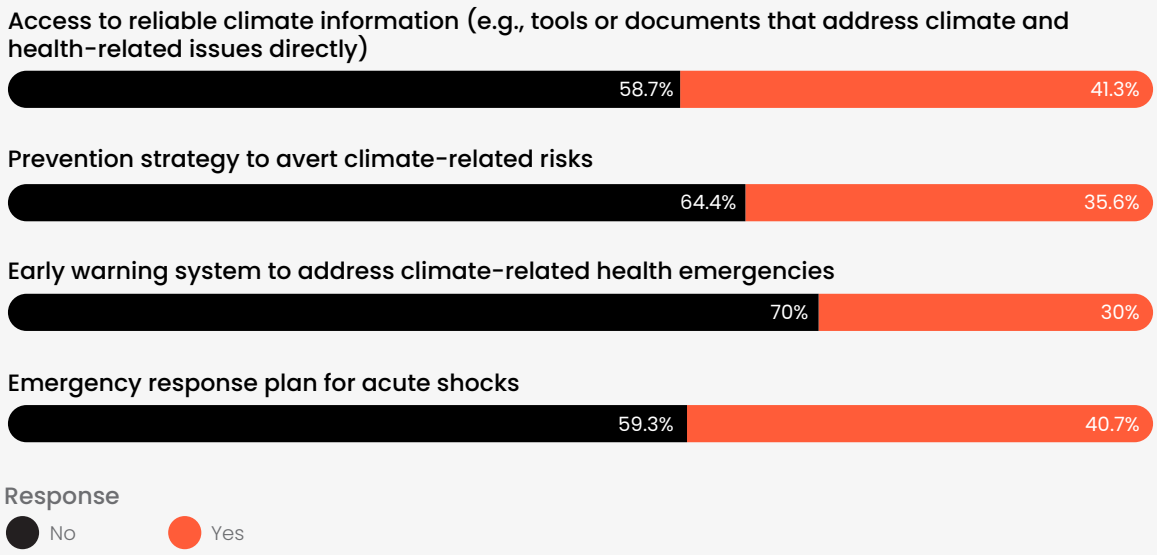


FIGURE 7 Availability of Climate-related Information and Response Readiness



Adaptation strategies that cities have successfully implemented are described in more detail later in this report (Sections II and III).

3. MITIGATION ACTIONS AND HEALTH CO-BENEFITS

RECOMMENDATION 3:
Place prevention and health promotion at the forefront of climate mitigation strategies.

Prioritize city investments that will have the biggest impacts on health, such as affordable clean energy and a just transition toward elimination of fossil fuels; air quality; active transportation like implementing safe cycling/walking routes and zero-emission public transport; food systems; and waste management. Recognize that every climate mitigation action is a health action, with important co-benefits.

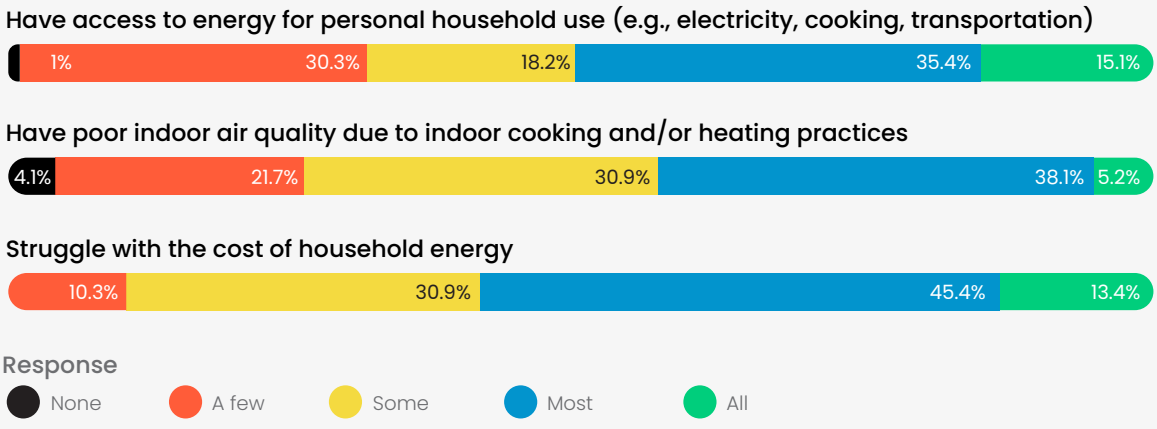
Mitigation must be scaled up immediately to improve and protect global health. The Lancet describes "common but differentiated global responsibilities" that must be prioritized to maximize health benefits while minimizing trade-offs. Energy, air pollution, food systems and the healthcare sector are the focus of this indicator category.

"To help our city decrease air pollution and mitigate climate change impacts, we need to urgently invest in renewable energy sources, enhance green spaces and urban forestry to mitigate heat island effects, and promote active transportation options like walking and cycling to encourage physical activity."

Survey Respondent

Overall, about 50% of respondents reported that "all" or "most" of their residents have access to energy for personal household energy [Figure 8]. However, many residents struggle with the cost. As expected, this differed by city size, region, and OECD classification. However, even in high-income countries, only 75.0% responded that all or most of their residents had access to household energy (compared to 44.4% in low-income countries).

FIGURE 8 Energy Use

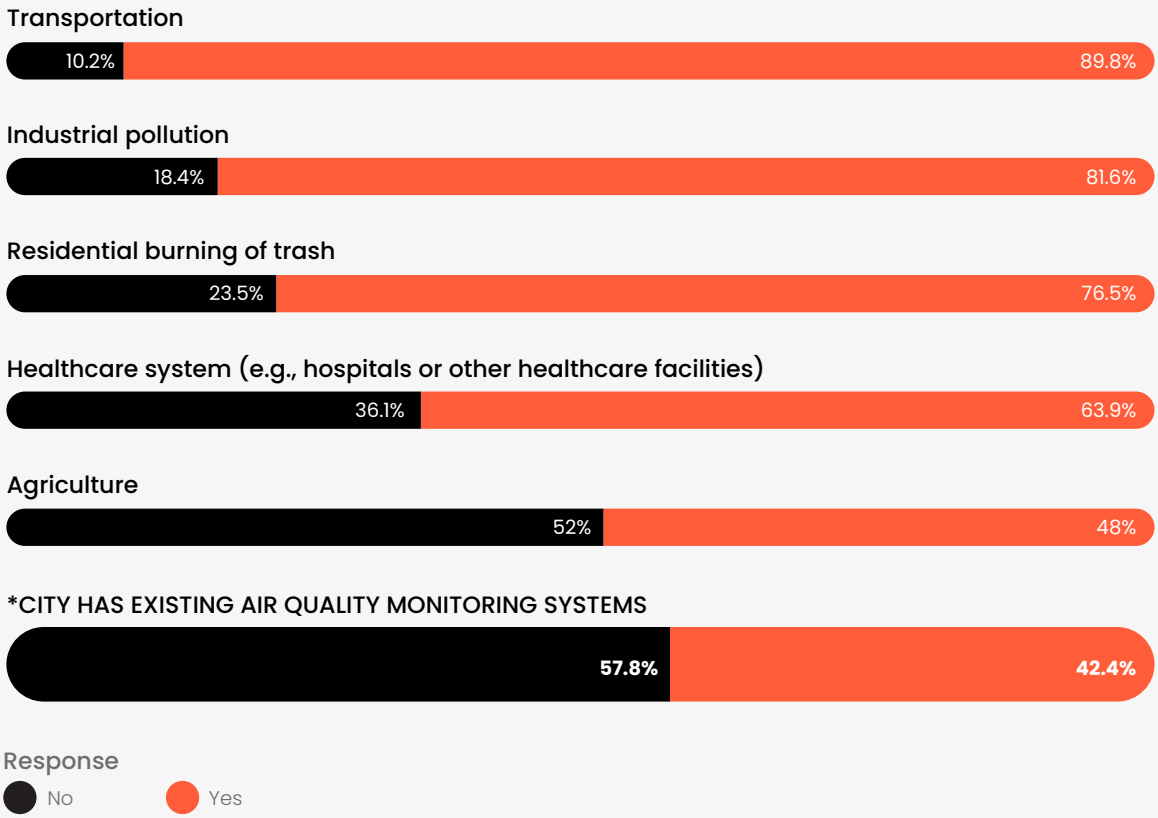


Food systems within cities were often rated "poor", and many cities worried about the effects of climate change on food insecurity and undernutrition. Only 17.6% of cities said that all or most of their residents had access to healthy and affordable food options. In contrast, 64.9% rated food security and undernutrition as a major concern: as expected, this was most often the case in cities in LMICs; in Africa, Latin America, and the Caribbean; and in dry climates where risk of drought is greatest.

Regardless of size, about 30% of all cities responded that all or most residents have access to parks, urban forests or other green space for recreation and well-maintained walking or cycling paths for active transport. These are more common in cities in high- and middle-income countries rather than those in low-income countries. Green space in cities and active transport have both been associated with positive health outcomes such as better mental health, lower rates of obesity and consequent reduced risks for diabetes, heart disease and stroke.

Finally, most cities report concerns about air pollution from many sources, especially transportation, industry, residential burning of trash, and the healthcare system, and agriculture [Figure 9]. Despite this, only 42.2% report that their city has an existing air quality monitoring system, which was more common in larger cities and those in high- and upper-middle-income countries.

FIGURE 9 Concerns about Air Pollution from Various Sources and Air Quality Monitoring



4. ECONOMICS AND FINANCE

RECOMMENDATION 4:
Redirect financial flows to investments that have climate and health co-benefits.

Invest in green infrastructure, renewable energy, and energy-efficient systems; leverage economic opportunities of transitioning to a zero-carbon economy which will improve outcomes for planetary and human health. Cities must also address the cost of inaction against current climate-health trajectories.

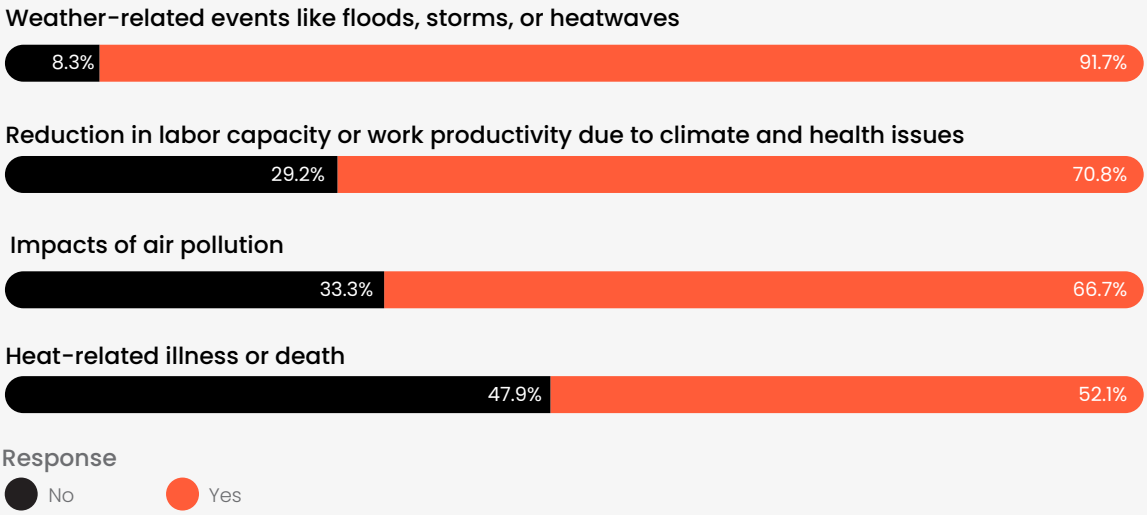
"We have unlimited need and very limited resources."

Survey Respondent

Economic impacts associated with climate change include losses due to extreme events, mortality, reduction in labor capacity, and costs in transitioning to zero-carbon economies. The Lancet suggests eliminating harmful financial flows and supporting a healthy future through redirection of funds to climate interventions.

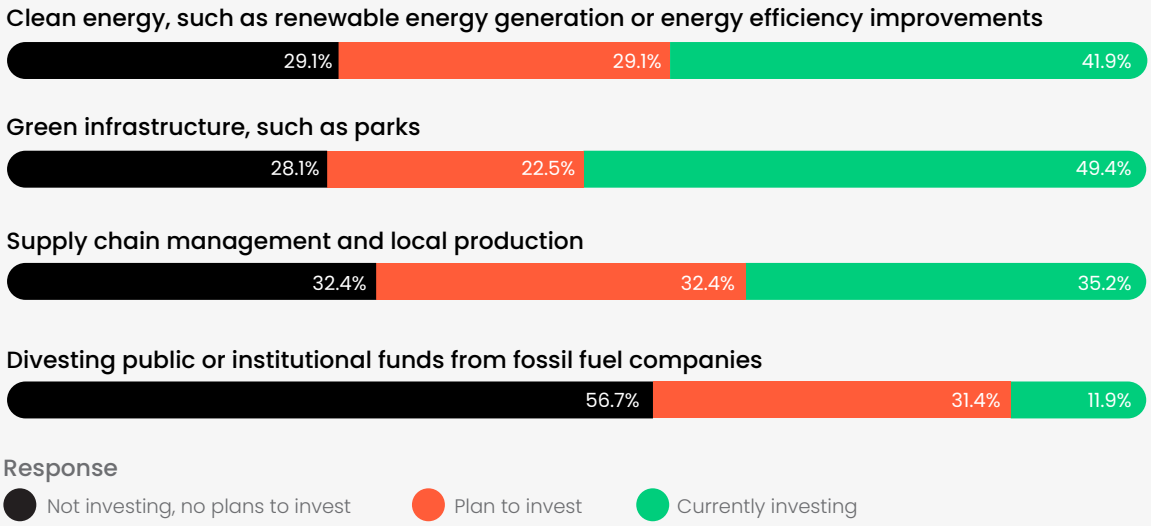
Most cities have already experienced economic losses due to weather-related events like floods, air pollution, and heat. They also report a reduction in labor capacity or work productivity due to climate and health issues [Figure 10].

FIGURE 10 Economic Losses Already Experienced in Cities



Cities reported receiving limited investment to support climate initiatives from international or national sources (54.7%) or from local government or business (36.9%). There are often competing priorities for funding and concerns about managing funds for intersectoral initiatives. Nonetheless, many cities are investing or plan to invest in assets that can positively impact climate and health, such as green infrastructure, renewable energy or energy efficient systems, and supply chain management and local production [Figure 11].

FIGURE 11 Investments and Planned Investments in Climate and Health in Cities



Further attention should be given to the role of leadership and governance in obtaining investments as well as the regulations, policies and infrastructure that may facilitate or impede these financial flows. It is also critically important to recognize the costs of inaction against current climate-health trajectories. Most respondents (88.8%) believe that transitioning to a zero-carbon economy would create economic opportunities and benefits for their cities and their residents.

"[We need] financial support to advocate to political authorities to prioritize climate safety and health policies."

Survey Respondent

5. PUBLIC AND POLITICAL ENGAGEMENT WITH HEALTH AND CLIMATE CHANGE

RECOMMENDATION 5:
Foster collaborative multi-sector public and political engagement on climate, health and equity.

Leverage strong interest from city leadership to foster inclusive and proactive collaboration across sectors, including government, the scientific community, private-sector stakeholders, the media, and city residents. Organize policy dialogues, participatory planning sessions, and awareness campaigns to amplify climate-health messaging and catalyze investment. Foster meaningful and inclusive community engagement to ensure climate and health initiatives are equitable and community-led.

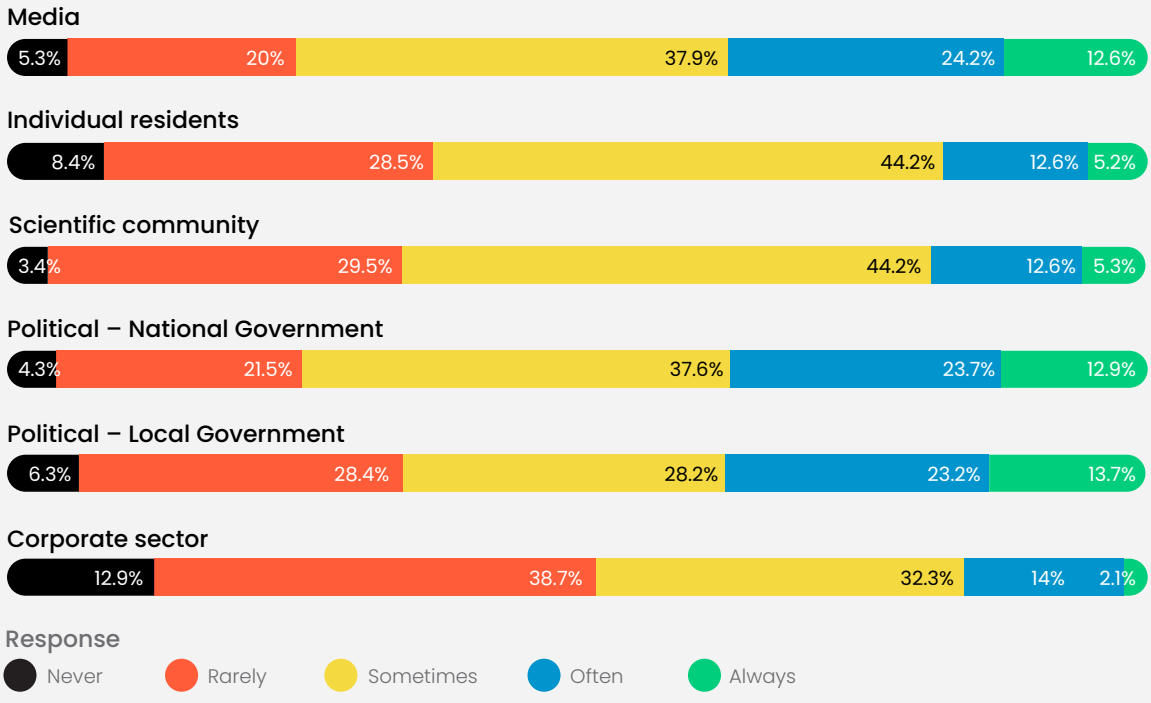
Within cities, public and political engagement regarding health and climate change has been limited to date. There is not consistent engagement from any of the stakeholders deemed of interest in the Lancet Countdown report: media, individual citizens, scientific community, political community/local government, and corporate/business interests [Figure 12].

In contrast, 55.1% reported that their city had hosted a participatory planning session or policy dialogue related to climate change, health and/or equity, particularly in North America, Europe and the Middle East. Among those who reported no engagement to date, 73.7% reported an interest from city leadership to actively engage on these topics, particularly in cities in Latin America and the Caribbean. Strengthening public engagement enhances residents' understanding of the associations between climate and health, and in turn improves overall city preparedness.

"Mobilizing local communities to take part in health promotion activities can lead to more resilient populations."

Survey Respondent

FIGURE 12 Public and Political Engagement with Health and Climate Change



Summary of Quantitative Survey Results from City Leaders in 118 Cities, Organized by Indicators of the 2023 Lancet Countdown Report with Further Details on City Characteristics

1. Health hazards, exposures, and impacts

1.1. HEAT AND HEALTH

>65% **of cities rate heat of high concern**

Heat was a particular concern in Latin America and the Caribbean (94.1% rated high concern, compared to 62.5-77.2% in other regions) and in large cities (83.1% rated high concern, compared to 65.0-73.9% of medium and small cities). Cities also recognize adverse impacts of heat on opportunities for outdoor activities, and reduction in labor capacity/worker productivity.

1.2. HEALTH AND EXTREME WEATHER-RELATED EVENTS

66.4% **of cities rate extreme weather events of high concern**

Extreme weather events like flooding were of concern to 66% of cities – and of particular concern in coastal cities (71.4%); those classified as tropical (Koppen Index, 71.5%); cities in LMICs (72.0%); and cities in Latin America and the Caribbean (76.5%) and North America (75.0%).

Although not an explicit indicator of the Lancet Countdown, we asked about mental health issues such as chronic stress, anxiety and depression regarding climate: 66.4% of cities rated this as a "high concern." Most prevalent in Africa as well as Europe and the Middle East (both > 75%) and cities in LMICs (83.4%).

1.3. CLIMATE SUITABILITY FOR INFECTIOUS DISEASE TRANSMISSION

68.8% **concerned about greater exposure to infectious diseases**

Nearly 7 in 10 cities (68.8%) were concerned about greater exposure to climate-sensitive infectious diseases (e.g., dengue, malaria). Following epidemiological trends, cities rating this issue of "high concern" were most likely to be large cities (71%); tropical (Koppen Index, 77%); cities in LMICs (89%); and in Africa (82%) and Asia-Pacific (74%).

1.4. FOOD SECURITY AND UNDERNUTRITION TRANSMISSION

64.9% **high concern about drought/food insecurity**

Drought and consequent concerns about food insecurity and undernutrition were rated of "high concern" for 64.9% of cities. These concerns exceeded the average response in inland cities (71.4%) and those classified as dry (Koppen Index, 77.8%); cities in LMICs (70.3%); and in Africa (75.4%), Latin America and the Caribbean (68.8%).

2. Adaptation, planning, and resilience for health

2.1. ASSESSMENT AND PLANNING OF HEALTH ADAPTATION

22.9% **of cities have plans for climate and health**

60% of cities have a City Resilience Plan or other planning documents or tools that address climate threats. However, only 22.9% of cities have plans that explicitly address health. These are most often found in large cities; cities in high- and upper-middle income countries; those in Latin America and the Caribbean, Europe and the Middle East, and North America. Approximately 20% report "always" or "often" coordinating between city departments to address climate shocks or stresses.

Few cities have reliable access to early warning systems (30.0%); climate information (e.g., heat, air quality forecasts) (41.3%); a prevention strategy to avert climate-related risks (35.6%); and an emergency response plan for acute climate shocks (40.7%). Small cities, those in Africa, and in LMICs report being least prepared.

2.2. ENABLING CONDITIONS, ADAPTATION DELIVERY, AND IMPLEMENTATION

Most rate city systems "fair" or "poor"

Most cities rate their basic systems – waste, water, food, healthcare – as "fair" or "poor". This has profound effects on readiness in the event of a climate event, particularly for small cities (waste); large cities (water); those in LMICs; and in Africa – based on city leaders' reports. Respondents in Europe and the Middle East had the lowest ratings for healthcare systems vis-à-vis climate resilience.

2.3. VULNERABILITIES, HEALTH RISK, AND RESILIENCE TO CLIMATE CHANGE

100% **recognize vulnerabilities populations**

All cities recognized the vulnerabilities of certain populations. Ratings of "very concerned" were endorsed by a high proportion of respondents when referring to older adults (78.9%), children (77.8%), those living in informal settlements (65.4%), outdoor laborers (57.1%), and those who have migrated from rural areas of other countries (43.0%). When asked to select the group of greatest concern in terms of threats to climate and health, most cities selected children.

3. Mitigation actions and health co-benefits

3.1. ENERGY USE, ENERGY GENERATION, AND HEALTH

50.0% **of residents have access to energy, but costs are high**

Overall, 50% of respondents reported that "all" or "most" of their residents have access to energy for personal household use. However, many residents struggle with the cost of household energy. As expected, this differed by city size, region, and OECD classification. However, even in high-income countries, only 75.0% responded that all or most of their residents had access to energy (compared to 44.4% in low-income countries). Cities in Latin America reported best access (85.6% all/most) whereas those in Africa reported the least access (29.3% all/most).

3.2. AIR POLLUTION AND HEALTH CO-BENEFITS

89.9% **have concerns about air pollution from 1 or more sources**

Most cities reported concerns about air pollution from a variety of sources: transportation (89.8%); industry (81.6%); residential burning of trash (76.5%); hospitals and healthcare facilities (63.9%); agricultural production (48.0%). Greatest concerns were expressed from cities in LMICs, including Africa and the Asia-Pacific region. Despite this, only 38.0% report that their city has an existing air quality monitoring system. Air quality monitoring is more common in cities in high- (66.7%) and upper-middle-income countries (60.0%) versus low-income countries (25.0%), and in Asia-Pacific and North America. Half of large cities have air quality monitoring compared to 27.8% of medium and small cities.

3.3. FOOD, AGRICULTURE, AND HEALTH CO-BENEFITS

Urban food systems rated poor

Food systems within cities were rated poor and many cities worried about the effects of climate change on food insecurity and undernutrition. Few cities report that "all" or "most" of their residents have access to healthy and affordable food options nor to urban community gardens.

We also asked about transportation options which can have health co-benefits. Many cities report having public transportation options accessible to most residents (43.0%) and well-maintained walking and/or cycling paths (35.1%) in their cities, particularly in high-income countries and in the following regions: North America, Latin America and the Caribbean, Europe and the Middle East. Few cities have yet broadly adopted low-emission vehicles such as electric or hybrid busses (24.5%); these are most common in high-income countries in North America, Europe and the Middle East.

3.4. HEALTHCARE SECTOR EMISSIONS

63.9% **concerned about healthcare sector emissions**

As mentioned earlier (section 3.2), two-thirds of cities are concerned about healthcare sector emissions. This is most pronounced in small cities, LMICs, and Africa. It is estimated that the healthcare industry contributes about 5% of total greenhouse gas emissions and toxic air emissions contributing to the adverse effects of climate change – up to 10% in industrialized countries. Sustainable healthcare initiatives are warranted.

4. Economics and finance

4.1. ECONOMIC IMPACT OF CLIMATE CHANGE AND ITS MITIGATION

91.7% **reported economic losses due to weather related events**

Nearly all cities (91.7%) report economic losses due to weather-related events like floods, storms, or heatwaves. Many cities reported economic losses due to heat (52.1%), air pollution (66.7%), and reduction in labor capacity (70.8%) due to climate change. There were no discernible differences by coastal region, size, Koppen Index, region, or OECD designation. However, it is likely that severity of impact and the financial implications were worse in LMICs and cities with the least infrastructure.

4.2. ECONOMICS OF THE TRANSITION TO ZERO-CARBON ECONOMIES

Many cities investing/planning to invest in clean, renewable energy or efficiency improvements

Many cities are already investing in/planning to invest in clean energy, renewable energy generation or energy efficiency improvements (41.9% invested/29.1% planning); green infrastructure such as parks (49.4%/22.5%); and supply chain management and local production (35.1%/32.4%). These investments or planned investments are more prevalent in large and medium-sized cities; high- and upper-middle-income countries; and in all regions other than Africa. Few cities report external funds to support their climate adaptation effort, either through national or international funding (54.7%) or local government or business funding (36.8%). Nearly all cities (88.8%) said that transitioning to a zero-carbon economy would create economic opportunities and benefits for their city and its residents – an opinion endorsed across all cities regardless of stratification.

5. Public and political engagement with health and climate change

% of cities reporting that the following sectors "always" or "often" share information on health and climate change

37.0% MEDIA

Media engagement across cities was modest, with 37.0% reporting that local news and social media "always" or "often" share information about climate change and health. There is no discernible pattern of differences across city size, region, etc.

17.9% INDIVIDUAL

Individual engagement was low, with 17.9% reporting that residents "always" or "often" share information about climate change and health. There is more engagement in North America and high-income countries.

35.8% SCIENTIFIC

Scientific engagement was modest, with 35.8% reporting that the scientific community "always" or "often" share information about climate change and health. There is more engagement in large cities.

36.6% POLITICAL

More than one-third of cities (36.6%) report that the national government "always" or "often" shares information about climate change and health; there is higher engagement in Asia-Pacific and high-income countries. Similarly, local governments have modest levels of engagement (36.8%); higher engagement (>50%) is reported in large and medium-sized cities and high-income countries, with the highest regional representation from local governments in North America and Latin America and the Caribbean.

16.1% CORPORATE SECTOR

Corporate sector engagement was low, with 16.1% reporting that businesses or corporations "always" or "often" share information about climate change and health. There is more business engagement in North America.

Notes. Stratifications are based on a priori designations: City population size (OECD) – large >1.5 million, medium=0.5-1.5 million, small <0.5million. Income level based on gross national income per capita (World Bank) Low <$1135, lower-middle =$1360-$4465, upper-middle=$4466-$13,845, high-income >$13,846. Koppen climate index = (A) tropical, (B) dry, (C) temperate, (D) Continental. Continent and coastal designation also considered.

B. WORLD HEALTH ORGANIZATION BUILDING BLOCKS OF HEALTH SYSTEMS

RECOMMENDATION 6:
Promote climate resilient & sustainable healthcare initiatives.

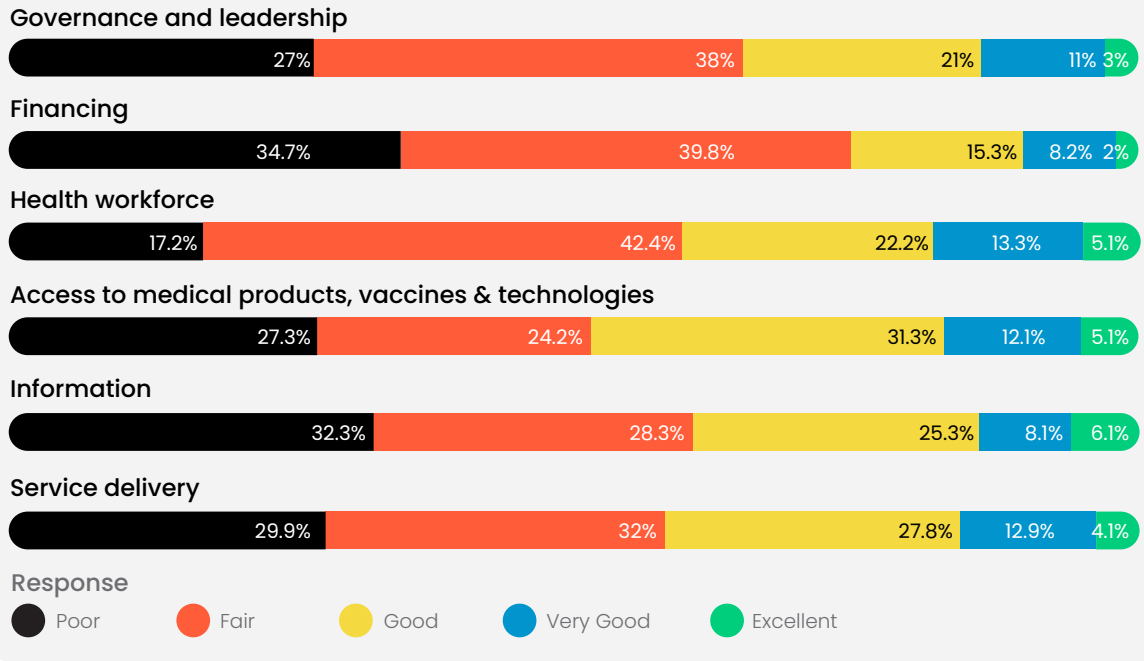
Recognize that hospitals and health centers are anchor institutions in cities. City governments should partner with healthcare providers and administrators to promote community health, patient education and outreach, and reduce carbon emissions generated by health facilities. Health systems must be prepared and resourced (including workforce and facilities) to withstand and adapt to climate change impacts, ensuring continuity of care.

In addition to the Lancet Countdown categories, we included an evaluation of The World Health Organization's (WHO) six essential building blocks of the health system: governance and leadership; financing; health workforce; access to medical products, vaccines and technologies; information; and service delivery. Few respondents in our survey rated their health systems' building blocks as "excellent" or "very good"; most rated these as "fair" or "poor". Overall ratings did not differ discernibly by region, OECD ratings (low/middle/high-income countries), or by city size – though ratings in small cities, those in Africa and other LMICs were slightly lower across all six building blocks. However, even larger and wealthier cities in North America and Europe rated their health systems poorly; this is likely due to differences in expectations – in all cities, expectations were rarely met. Moreover, the Covid-19 pandemic laid bare many weaknesses in the health and public health sectors; the entire sector has not yet recovered and, if anything, faces exacerbated strain due to persistent personnel shortages.

"To effectively support health in a city like ours, especially in the face of climate change, a comprehensive array of resources is essential. Addressing the multifaceted health challenges requires not only physical infrastructure but also a robust framework for data collection, analysis, and a well-trained workforce."

Survey Respondent

FIGURE 13 City Leaders' Evaluation of the WHO Building Blocks of Health Systems



C. DATA COLLECTION AND SURVEILLANCE CAPABILITIES

RECOMMENDATION 7:
Enhance data infrastructure and surveillance capabilities.

Integrate climate-health data systems and digitize to assure more timely responses; establish early warning mechanisms; and leverage community needs assessments and surveillance to improve preparedness and responses to climate-related health risks. Use data to forecast future health impacts that could result from a changing climate to inform long-term strategic decision-making in cities.

Recognizing the importance of data-driven planning to promote climate and health resilience, we asked about whether cities had health data collection and surveillance capabilities. Overall, 17.0% reported no data or surveillance capabilities; 44.0% reported analog only (e.g., paper records, collection via community health workers); and 39.0% reported at least some digital infrastructure (e.g., electronic health records, central database). As expected, this varied widely, with large cities and at least half of those in Asia-Pacific, Europe and the Middle East and North America reporting some digital health infrastructure.

"To support health in our city, we need access to comprehensive data and surveillance systems to monitor climate-related health impacts and identify vulnerable populations."

Survey Respondent

Data systems can support city leaders and communities in their development of strategies and programs to address the health effects of climate change. The US Centers of Disease Control and Prevention suggests combining meteorological data and projections with epidemiological data to more effectively anticipate, prepare for, and respond to climate-sensitive health impacts.[26] Their Building Resilience Against Climate Effects (BRACE) framework recommends a five-step circular process that emphasizes health equity: 1) anticipate climate impacts and assess vulnerabilities; 2) project the disease burden; 3) assess public health interventions; 4) develop and implement a climate and health adaptation plan; and 5) evaluate impact and improve quality of activities.

FIGURE 14 Data Collection and Surveillance Capabilities

D. GLOBAL COLLABORATION AND SCALE-UP

RECOMMENDATION 8:
Foster city-to-city collaborations and knowledge exchange initiatives.

By engaging in active dialogues and partnerships with other cities, local governments can share best practices, innovative solutions, and lessons learned to address climate action, public health, and social equity. Such collaborations not only inspire and educate local stakeholders but also create a global network of resilient urban communities committed to addressing common challenges through collective intelligence and mutual support.

More than 80% of respondents expressed an interest in ongoing engagement with Urban Pulse. They were eager to get more information, contribute data, participate in a Community of Practice (CoP) on climate and health, and collaborate on future research. Stakeholders emphasized the need to leverage existing collaborative networks such as Resilient Cities Network, C40, ICLEI and others. This would strengthen the resilience ecosystem with tools and knowledge to tackle challenges at the intersection of climate, health and equity.

Driven by this expressed need of our member cities, the Climate, Health and Equity Community of Practice was launched in May 2024 during a knowledge exchange convening of 12 cities hosted by Mexico City and the Resilient Cities Network. This will support city-to-city collaboration and promote climate and health resilience by creating a dynamic, open, and reliable space for long-term collaboration, problem solving, and mutual support. It can help foster a shared mission, propelling the integration of climate resilience and health into urban governance and strategy globally.

II. Top 10 City-Level Resilience Solutions: Thematic Analysis

The qualitative survey analysis focused on identifying solutions for climate and health resilience. These solutions were identified through two questions that probed for innovative city-level initiatives that have been or are currently being implemented. Using thematic analysis software (Dedoose, Los Angeles CA), nearly 300 qualitative excerpts were categorized into 10 primary areas of focus. Results are organized based on frequency of mentions, with details provided in the following pages. Each section begins with a brief summary of the relevance of the interventions for health.

1. **Greening Initiatives** (50 responses)
2. **Health-Related Interventions** (47 responses)
3. **Data Infrastructure for Surveillance, Planning Disaster Management** (30 responses)
4. **Public Awareness and Community Engagement** (30 responses)
5. **Waste Management** (21 responses)
6. **Water Systems** (19 responses)
7. **Transportation and Urban Planning** (19 responses)
8. **Heat Mitigation** (12 responses)
9. **Food Systems** (10 responses)
10. **Clean Energy** (8 responses)

Total across categories exceeds the excerpt/response count due to overlapping themes and codes. Some cities had more than one respondent.

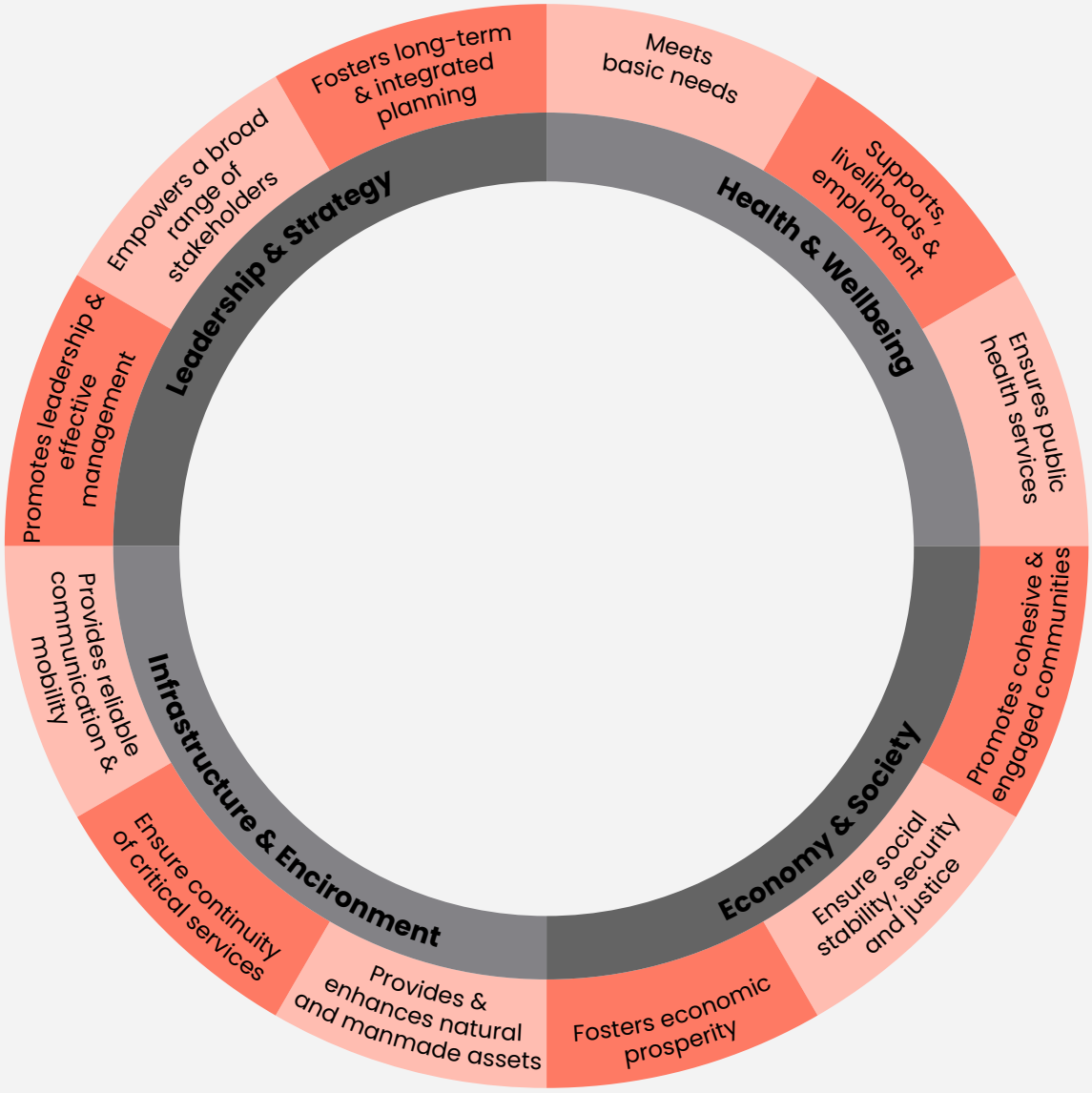
RECOMMENDATION 9:

Build on cities' successful implementation of programs and policies designed to promote climate and health resilience.

Amplify and scale existing programs while investing in evidence-based innovations that continue to be rigorously monitored for impact. These can be categorized as initiatives for climate adaptation or mitigation and those that create an enabling environment by strengthening fundamental city systems.

The thematic categories were mapped using the City Resilience Framework (CRF). Developed by The Rockefeller Foundation and ARUP,[27] the CRF is a conceptual framework that offers a common reference point to characterize features of resilient cities. The CRF was developed based on extensive research examining existing literature, case studies, and fieldwork. It offers an evidence-based, holistic articulation of city resilience structured around four categories: Health and Wellbeing; Infrastructure and Environment; Economy and Society; and Leadership and Planning. Catalyzing involvement of civil society, local governments, and business, the framework highlights strengthening health through multi-sector engagement. Figure 15 illustrates that, taken together, the thematic categories that emerged from the open-ended survey responses address each of the four domains of urban resilience.

FIGURE 15 Thematic categories mapped against City Resilience Framework



1. Greening Initiatives

Many cities are Implementing greening initiatives that expand urban green spaces, improve air quality, and enhance climate resilience by leveraging community engagement, public awareness, and partnerships with local organizations. Greening initiatives reduce the risk of adverse impacts of climate change on health and equity.[28]

- ✓ Lack of green spaces results in greater heat via the urban heat island effect; greening initiatives can reduce these risks, especially in vulnerable neighborhoods.[29]
- ✓ Urban tree cover and green spaces improve air quality.[30]
- ✓ Nature based solutions can have positive impacts on shock events such as reducing the risk and severity of flooding.[31]
- ✓ Access to green spaces improves mental health.[32]

Freetown, Sierra Leone, has implemented Freetown the Treetown Campaign, an ambitious ecosystem adaptation project that aims to plant and digitally track planted trees over the next 26 years to reach a target of 20 million trees by 2050.[33] Increasing urban forests, parks, and green corridors increases carbon capture and reduces air pollution and heat. In turn, this lowers the incidence and severity of respiratory (e.g., asthma) and heat-related illnesses. These efforts also prevent coastal erosion and flooding, thus enhancing water security. Funded through tree sales on private and carbon markets, the campaign is implemented by the city in collaboration with local NGOs. The city collaborates with local leaders to promote tree planting in informal settlements, schools, and residential areas. Moreover, it has created job opportunities for more than 2,500 residents.

The Greening Our Neighborhoods project in **Lira City**, Uganda, focuses on increasing and enhancing urban green spaces, while promoting active transportation through the development of bike lanes and pedestrian-friendly streets to improve health outcomes. The project utilizes principles of community engagement and public awareness, including participatory design workshops and volunteer events, to encourage a sense of ownership among city residents. They developed educational materials and leverage public events to inform city residents about the interconnectedness of climate change, urban greenspace, and public health.

Juárez, Mexico, has an urban gardening initiative under the Rural Development Directorate that distributes seeds and provides virtual gardening training. They also include outreach to inform the public about the benefits of green roofs for climate resilience and heat reduction. **Montréal**, Canada, collaborates with their Public Health Department to make their greening initiatives more equitable by linking a Climate Vulnerability Index with a community-based Greening Mapping Tool. They are working to increase access to green spaces to be within 15 minutes' distance for all city residents. **Nakuru City**, Kenya, encourages tree planting and gardening through various institutions such as the City Management Board, Egerton University, and Kenya Malaria Youth Corps. **Nairobi**, Kenya, goes even further: they incentivize building owners to install vegetated rooftop systems through tax breaks and assistance with planning and implementation.

2. Health-Related Interventions

Health-related interventions address the direct and indirect health impacts of climate change through initiatives such as vector-borne disease control, flood risk management, and mental health support.[34]

- ✓ Warmer temperatures result in wider geographic spread of vector-borne diseases, including some places that have never had vector-borne diseases before – and therefore lack readiness to prevent and treat.[35]
- ✓ Rising sea levels and flood waters can result in injury and disease.[36]

- ✓ Climate change and extreme weather events can lead to increases in depression, post-traumatic stress disorder, and climate anxiety.[37]

More than a quarter of cities provided information about climate and health solutions. **Lusaka**, Zambia, has implemented an extensive cholera immunization program. In Southern Africa climate change is resulting in increased rainfall, which is causing pit latrines to overflow, contaminating local water supplies, and causing severe cholera outbreaks. The immunization program is helping to save lives; however, more resources are required to build capacity to meet the increased burden of disease.

Some cities recognize the link between climate change and non-communicable diseases – for example, the impact of air pollution on chronic asthma and other respiratory diseases. Extreme heat and heatwaves have direct effects on health, from preterm birth to premature mortality. Temperature changes can also trigger susceptibility to diabetes as well more severe and uncontrollable symptoms that may result in dehydration, hospitalization and death. The Diabetes Awareness Trust, a non-profit based in **Nairobi**, Kenya, contributes to healthier outcomes among informal settlement residents through health education, and advocates for sustainable, environment-friendly living practices.[38]

In **Norfolk**, United States, respondents were concerned about lack of access to fresh food options and recognized that food insecurity is exacerbated by hurricanes and consequent infrastructure damage. The city is designing its Coastal Storm Risk Management project in collaboration with the Southside community, which is highly vulnerable to flooding. The Ohio Creek Watershed Project, under Norfolk's Department of Housing and Urban Development, emphasizes the importance of mental health through the provision of recreational opportunities such as construction of fishing piers for its residents.

Surat, India, prioritizes community mental health, with a special focus on children and adolescents as part of its Urban Health and Climate Resilience Center of Excellence, the nodal technical support agency to the Surat Municipal Corporation.[39] The Center also conducts city-level spatial urban health and climate resilience assessments, houses a Vector Borne Disease Control Unit, and has public-private partnerships in place to mitigate health emergencies caused by disasters.

3. Data Infrastructure for Surveillance, Planning and Disaster Management

Cities recognize the urgent need to enhance data infrastructure, including real-time surveillance, by developing integrated climate and health data systems, establishing early warning mechanisms to improve preparedness, and rapid response to climate-related health risks.

- ✓ Data systems contribute to early warning systems that can avert or reduce adverse impacts of extreme climate events.[40]
- ✓ Integrated climate and health data and surveillance systems help cities improve their capacity to understand, map, monitor, anticipate, and better prepare for climate related health risks, including communicable and non-communicable diseases, nutrition, mental health, and injuries caused by extreme weather.[41]
- ✓ Increasingly, extreme weather events like heatwaves, flooding, mudslides, tornados, and hurricanes pose major health threats and often result in damage to electrical, water, food, and health systems.[42]

Cities recognized the importance of data infrastructure and surveillance to facilitate their response to climate and health threats. A respondent from **Wakiso**, Uganda, highlighted the importance of ongoing community needs assessments in building climate and health resilience: "We are always adapting [our] plans and approaches based on new information and perspectives." Cities like Caracas, Venezuela, are using data to complement their Risk

and Climate Crisis Management Plan through risk stratification to demarcate vulnerable regions. **Bangkok**, Thailand, uses mobile air quality monitoring devices to collect data from across the city.

Rio de Janeiro, Brazil, has an Operations and Resilience Center that houses several projects for monitoring and evaluating public health indicators and epidemiological scenarios to assist the decision-making processes of the city's Municipal Health Secretariat. This approach was developed in response to severe challenges, including a 2010 landslide that killed 68 people and left 15,000 homeless, primarily affecting the urban poor in favelas. The city's vulnerability to flooding and extreme temperatures, which can reach 45 degrees in urban heat islands, underscores the critical link between climate change and public health, necessitating comprehensive disaster management to protect the health of city residents. Data collected by the Center are used to anticipate solutions and alert responsible sectors about risks related to emergency situations.

Surveillance data are used to inform early warning systems for heatwaves in the city of **Abidjan**, Côte d'Ivoire, and for water levels in the city of **Melaka**, Malaysia. **Cape Town**, South Africa, uses data to map populations at risk for both climate and health threats while underscoring the need for ongoing data analysis of urban health stresses. **Guadalajara**, Mexico, has a Monitoring, Evaluation, and Review system under its Climate Action Plan for the purposes of analyzing mitigation, adaptation, and governance actions being taken. Using this system, "challenges are visualized annually, analyzing new methodologies to be used in each strategy." The Health Secretariat conducts epidemiological surveillance of climate-related health issues such as hypothermia, heatstroke, and heat exhaustion, in addition to carrying out preventive actions for vector-borne diseases such as Arboviruses. The Government of Jalisco in **Guadalajara** reports considerable progress in the execution of entomological surveys in priority localities at risk of vector-borne disease incidences, monitoring of climate-related vector borne illnesses such as dengue and Zika, and detection and notification through the Surveillance System for Health Damage from Extreme Temperatures.

Other solutions focused on leveraging data infrastructure for disaster and emergency management. These include an incident management system in **Surat**, India, which has a unique public private partnership to bolster health management efforts in emergencies; a proactive disaster response system in **Baguio City**, Philippines; extreme weather warnings in **Dar es Salaam**, Tanzania; and the Ohio Creek Watershed Project in **Norfolk**, United States, which mitigates flood risks through the construction of new trails co-located with flood levees to enhance safety. The Saidika Organization in **Nairobi**, Kenya, is working to enhance emergency response systems to address health impacts of extreme weather events. **Cape Town**, South Africa, is building organizational awareness of climate hazards and vulnerabilities, conducting analyses to identify urban health stresses, developing a flood risk mitigation plan, and generating climate event trigger models to better inform implementation of appropriate interventions.

4. Public Awareness and Community Engagement

Public knowledge, awareness, and perception of climate change improves preparedness and can increase compassion.[43] Cities are increasing public awareness and community engagement by leveraging educational campaigns, community-based programs, and participatory planning sessions to enhance climate preparedness and resilience.

- ✓ People who have had past experiences with climate disasters are more likely to prepare.[44]
- ✓ Community engagement is crucial to equitable approaches that reach the entire population.[45]
- ✓ There is a strong link between public knowledge and engagement that can encourage and motivate the public to climate change action through policy instruments.[46]

Communities in **Lagos**, Nigeria, are trained by the Ministry of the Environment and Water

Resources to create and execute flood assessment plans as opposed to depending on government intervention alone. Daily weather forecasts and river gauging data are relayed to residents to keep them informed about impending risks. The city of **Kano**, Nigeria, takes a communal approach by engaging tertiary level students in volunteering activities geared towards climate change management. There are also several community-based programs for tree planting, cleaning drives, and recycling. Cities like **Dar es Salaam**, Tanzania, encourage youth participation in climate awareness programs to build climate resilience. **Kabul**, Afghanistan, has educational campaigns underscoring preventive healthcare measures and preparedness for climate-related emergencies.

Buenos Aires, Argentina, has implemented the Adaptation Program for Extreme Weather Events to increase awareness among older adults vulnerable to climate-related health risks. The city hosts workshops on prevention and personal care during heatwaves, and conducts outreach campaigns via email, voice calls, and text messages. Similarly, **Montréal**, Canada, collaborates with its regional police and public health departments on a door-to-door campaign to inform isolated and marginalized older adults about the health impacts of heatwaves. **Calgary**, Canada, has working groups called Climate Resilient Communities who meet monthly to build capacity and implement community-based adaptation strategies.

5. Waste Management

Waste and stormwater management are extremely important to reduce exposure to pollutants and disease; they are even more important with more extreme climate-related weather events.[47] Cities report efforts to improve waste management and stormwater systems to prevent spread of pollutants and vector-borne diseases. They are implementing comprehensive drainage cleaning programs, enhanced waste collection, and recycling efforts.

- ✓ Managing waste helps prevent the transmission of infectious and vector-borne diseases.[48]
- ✓ Extreme weather events with heavy rainfall and flooding can spread toxic pollutants in the soil and increase the transmission of water-borne and vector-borne diseases.[49]
- ✓ Poor waste disposal and management practices can cause or contribute to flood events, often leading to injury, disease or death.[50]

Many cities, including **Nakuru** and **Busia** in Kenya, and **Banjol** in Croatia, have drainage cleaning programs to reduce flood risk. The government of **Lagos**, Nigeria, has carried out construction, renovation and maintenance of drainage systems to allow free flow of stormwater, thus preventing formation of breeding grounds for disease-transmitting insects, pests, and rodents. **Lusaka City**, Zambia, collaborated with the World Bank to implement the Environmental Health and Pollution Management project focusing on hazardous and general waste management. The city also has cholera immunization programs developed in collaboration with the World Health Organization. **Wakiso**, Uganda contracts with private companies for general waste collection and policies on garbage disposal. **Berbera**, Somalia, has a Green and Clean project managed by the local government and encompasses sanitation and hygiene-based efforts. **Bukavu**, Democratic Republic of Congo, and **Nairobi**, Kenya, have waste management programs focusing on plastic recycling.

6. Water Systems

Water management systems must be in place for extreme weather events that cause flooding or heavy rainfall, assuring clean water for drinking, cooking, and bathing for all people in a community – especially those most vulnerable.[51] Many cities have invested in developing climate-resilient water management systems by implementing alternative water sources, quality monitoring, and flood management solutions.

- ✓ Extreme weather events often disrupt access to clean drinking water.[52]
- ✓ Establishing alternative sources of water and climate-resilient water systems support impacted water systems.[53]

- ✓ While there is variation in performance by type and environment, flood management significantly reduces flood damage.[54]

Given how fundamental water is to life, many cities have actively engaged in protecting and/or improving their water systems. **Salvador**, Brazil, has implemented Project Mané Dendé, a revitalization project for a watershed in the suburbs. **Montevideo**, Uruguay, has mapped and identified alternative water sources for the population and monitors water quality from hospital sources in response to its water emergency of 2023. **Rio de Janeiro**, Brazil, has implemented an environmental sanitation program with the municipalities surrounding Guanabara Bay to improve water quality through basic sanitation and sustainable management practices. The government of **Jalisco**, Mexico, also monitors the quality of water for human use and consumption from the state's supply systems. **Jigawa**, Nigeria, has a community water safety plan and continued water quality monitoring systems. **Kabul**, Afghanistan, has implemented water management practices including rainwater harvesting and the construction of retention basins for storage purposes which help mitigate flood risks while also ensuring continued water supply for its residents.

The Cloudburst Management Plan in **Copenhagen**, Denmark, provides an innovative solution to recirculating rainwater.[55] Its main components include diverting excess rainwater to underground cloudburst tunnels that are then utilized to replenish the city's green surface solutions, representing a novel way to utilize rainwater that is conventionally disposed of without use. Finally, **Greater Manchester**, United Kingdom, has an integrated water management memorandum of understanding and plan that reflects a collaborative approach to the way the city plans for all elements of the water cycle, ultimately delivering sustainable water and flood risk management.

7. Transportation and Urban Planning

Public transportation is an important mitigation strategy to reduce carbon emissions with numerous co-benefits for health, including active travel (walking/cycling) that reduces risk for obesity and consequent respiratory, cardiovascular, and cerebrovascular diseases as well as reducing traffic accidents and consequent injuries.[56]

- ✓ Use of public transportation reduces greenhouse gas emissions.[57]
- ✓ Reducing air pollution from personal vehicles decreases associated health risks.[58]
- ✓ Encouraging active travel as part of climate mitigation helps reduce obesity, improve cardiovascular health, and reduce the risk for heart attacks and strokes.[59]
- ✓ Transportation is often part of larger urban planning efforts, which are crucial to build accessible and acceptable green, blue, and health infrastructure.[60]
- ✓ Building codes must consider flood zones, increasing heat, and other climate threats.

Lagos, Nigeria, has recently implemented a rail line project that has successfully integrated >20,000 commuters who would have previously use the city's high carbon-emitting buses. The city also provides residents with multiple public transportation options including railway services, ferries, compressed natural gas-powered cabs, and bus rapid transit. The government of **Dakar**, Senegal, is in the process of introducing electric railway services as well as electric buses.

The government of **Jalisco**, Mexico, in collaboration with the **Guadalajara** municipality, the British Embassy, and C40, has reorganized and reduced 77 public transportation routes in the city to 20 routes, thereby substantially reducing traffic congestion and carbon emissions. This region has been established as the first low-emission zone in Mexico and across Latin America. **Greater Manchester**, United Kingdom, also has a zero-emission bus network called the Bee Network. Notably, active transportation is encouraged in cities like **Lira**, Uganda, that have built green spaces with active transportation infrastructure such as bike and pedestrian-friendly lanes.

Transportation is one aspect of a broader set of urban planning initiatives. The Health Secretariat of Jalisco reports progress in areas such as strengthening health infrastructure in municipalities most vulnerable to climate change. Other examples of urban planning efforts include those by community-based organizations such as Saidika Organization in **Nairobi**, Kenya, who ensure that building codes are updated to withstand extreme weather events and improved indoor air quality. Under its Green Roof Program, Nairobi provides technical assistance to building owners in planning, design, and implementations, including assistance with permit applications. **Muhanga City**, Rwanda, affords its most vulnerable residents social protection such as provision of funds to rebuild roofs destroyed due to extreme weather events such as intense winds.

8. Heat Mitigation and Adaptation

We have seen 13 successive months of global record-breaking heat globally, and the two hottest days ever recorded were in July 2024. Due to warming temperatures and more severe and persistent heatwaves, heat mitigation is a critical adaptation strategy at the intersection of climate and health. Cities are working to reduce heat, especially urban heat island effects, through greening as mentioned above as well as other initiatives like changes in the built environment (e.g., cool building technologies, heat-absorbing paint) establishing cooling centers for residents.

- ✓ Global temperatures are rising, leading to more extreme heat and longer duration and severity of heatwaves.[61]
- ✓ Heatwaves and wildfires can result in heat stroke, cardiovascular stress, and death.[62] [63]
- ✓ Cities can take effective measures, including greening, shelters, and changes to building and city design, as part of their climate action agendas to cope with and prevent the adverse effects of extreme heat.[64]

Vancouver, Canada, has implemented a diverse range of programs to combat heat. For instance, through their Resilient Neighborhoods Program, they partner with community organizations to carry out wellness checks and establish seasonal readiness for conditions of extreme heat and wildfire smoke. The city has set up cooling centers and outdoor misting stations (including fountains and handwashing stations to increase water access) and devised an innovative Cool Kit program distributing "low-tech cooling materials" among residents who do not have access to mechanical cooling means (e.g., spray bottles, water bottles, cooling towels, gel packs).

To protect the health of informal sector outdoor workers against extreme heat, the Self-Employed Women's Association in the city of **Ahmedabad**, India, piloted the first ever parametric heat microinsurance plan which includes wrap-around benefits to protect their income and enable them to work more safely in conditions of extreme heat.[65]

Buenos Aires, Argentina, has implemented a Climate Shelter Network to provide cooling spaces for residents. It also has a project underway that focuses on assessing the relationship between morbidity and heatwaves to push for the official registration of people affected by extreme heat. Other cities like **Cape Town**, South Africa, have incorporated public awareness campaigns into their heat action plans to ensure that residents are aware of impending heat threats and take the requisite steps to protect themselves.

9. Food Systems

Food systems are significantly impacted by climate change, thus undermining health, with profound risks for under-nutrition and child stunting.[66]

- ✓ Extreme weather like heat waves, flooding and droughts impact food production.[67]
- ✓ Warming oceans alter fish and shellfish ranges for migration patterns, adversely affecting fisheries and productivity.[68]

✓ Weakened food systems result in decreased food production and access.[69]

Yola, Nigeria, has implemented the NutriMboa project which comprises the creation of a digital database of "the nutritional composition of local foods and a contextual mobile application" to enhance nutrition at the population level. The Abim District of **Karamoja** in Uganda, through the Young Africa Works project under the MasterCard Foundation, is equipping African youth with climate-smart agricultural practices to enhance food production.[70] An estimated 84% of young people in Karamoja are experiencing multi-dimensional poverty. Economic regression, food insecurity, women and youth unemployment and inequality have all resulted in the loss of lives and livelihoods in this region. This initiative aims to address poverty through encouraging innovation and entrepreneurship, while also increasing food security and improving health outcomes. **Nairobi**, Kenya, is focused on food systems transformation under the Kenya National Food Systems Dialogue which is in the planning phase and has identified challenges including food systems governance, policy and legal frameworks, as well as urban planning and zoning, among others.[71]

10. Clean Energy

Clean energy is a crucial mitigation strategy to reduce greenhouse gas emissions, as well as reducing adverse climate-impacts on health and creating co-benefits.[72] Some cities are promoting clean energy initiatives by supporting renewable energy projects, developing carbon inventories, and providing subsidies for innovations in clean energy. More investment is needed to reduce and ultimately eliminate carbon emissions and other greenhouse gasses.

✓ Reducing greenhouse gas emissions improves air quality.[73]

✓ Reducing water and soil contamination decreases toxic exposure to heavy metals.[74]

✓ Lack of access to clean fuels and electricity in the world's poor households is a serious risk for health; for example, use of wood burning stoves is associated with asthma and other respiratory diseases.[75]

Kampala, Uganda, has programs advocating for clean fuel for cooking through partnerships with organizations in the European Union such as the Global Green Growth Institute as well as local ones such as Uganda Green Enterprise Finance Accelerator.[76] **Penang**, Malaysia, documented its plans to develop a carbon inventory for the state with financial and technical support from the Malaysian federal government. The city of **Kabul**, Afghanistan, acknowledges the importance of renewable energy, citing its support for solar and wind energy projects, specifically for use in health facilities. **Ouagadougou**, Burkina Faso, has implemented a *National Biodigester Program* that can benefit urban farmers through subsidies of the cost of a biodigesters: semi-masonry technical devices that produce biogas for cooking and lighting, along with organic manure for soil fertilization. Anticipated benefits include reducing greenhouse gas emissions and enhancing agricultural resources.

Challenges and Opportunities

In other open-ended questions on the survey, respondents articulated challenges faced by cities in the implementation of climate and health programs as well as opportunities for change. It is important to note that some of these responses may have been reported by those who are not part of city government, and thus may not have complete information about city-level initiatives. Additionally, some responses come from sources who may have a stake in these initiatives.

Responses were diverse, though certain themes emerged including political intervention, inadequate capacity/capabilities, misaligned policies, and inequity in solutions. For example, one respondent from a Latin American city notes that by 2030, a high percentage of the city's population will be older than 60 and thus, "The city should prioritize older people because they are the population most affected by climate change [and] extreme temperatures. Unfortunately, the elderly population is an invisible and excluded group from risk management programs."

Other respondents expressed dissatisfaction with the deployment of temporary or "band-aid" solutions as opposed to root-cause solutions. For example, a respondent from a North American city notes that while the city's bike path has provided opportunities for recreation and nature immersion, mitigation is not a priority for the city. Another North American responded said, "We live on a bay that is expected to rise by nine feet over the next 80 years. This is extremely troublesome, but there is hardly any action to decarbonize. While there is some action to move a school to higher ground and renovate, there is no action to address the root causes of [the] climate crisis or to support healthier living."

A respondent from a West African city notes that while the government takes passive approaches to climate and health resilience, including advising against the construction of certain buildings and encouraging citizens to keep their surroundings clean, these efforts are not sufficient to produce meaningful, sustainable change in the city. The respondent recommends that the government make this agenda "legally-binding" such that policymakers can be held accountable for their actions.

A respondent from an East African city notes that even in the face of the city's comprehensive action plan, "the city authority failed to deliver the bare minimum due to continuous conflicts between the political and technical wings of the authority." They acknowledge that while the city has taken some initiative, such as greening roads in the city center and advocating for clean environments in its slums, proper drainage channels are essential to avoid overflooding. And they recommend protecting the natural environment by prohibiting human occupation of wetlands. Another respondent from the same city echoes the shortcomings of the city's program noting that it has "failed to deliver its objectives of a clean and organized city" due to political inertia or ineffectiveness.

Other respondents criticized the divisive and inequitable nature of policies and solutions. For instance, one respondent reported that while there are some loan packages to encourage residents to install solar panels in their homes, these programs are "for the very few rich people in the society." Similarly, another person notes that that it is hard for residents to contribute to climate and health action due to information and literacy gaps given that information is often circulated in English, especially in communities where people have low literacy.

In cities in low-income countries, especially, basic needs are not being met: there is inadequate access to drinking water, deficient sanitation and solid waste management, and inadequate healthcare services to deal with climate change. The water system is substandard, compelling residents to source water from wells and boreholes that are unhygienic and pose health threats. This respondent notes widespread corruption, political negligence, and lack of accountability.

A respondent from a city in North Africa notes that their city does not have the requisite capabilities to deal with "the degree of extreme need as well as the danger of exposure to the negatives of disasters resulting from change in the environment." To advance climate and health resilience, they underscore the need to: "Provide the necessary support to cover such needs such as improving the health system and providing resources to improve the policies of water and sanitation projects, infection control and prevention, as well as strengthening the information system and projects to improve the environment and climate."

III. Deeper Insights in Cities in Low- and Middle-Income Countries: Stakeholder Interviews

These city profiles draw from insights gathered directly from interviews conducted by the Urban Pulse team with representatives from eight cities in Africa, Asia, and Latin America. All eight cities are members of the Resilient Cities Network, with demonstrated commitment to climate and health resilience and to the Urban Pulse program. Respondents included city officials from climate, urban planning, health, environment and/or resilience departments. Interviews were designed as a follow-up to their survey responses to deepen understanding of city engagement with climate, health, and equity as well as to gauge interest in continued collaboration and exchange. Representatives who consented to being interviewed in the survey were contacted by email. Interviews were conducted remotely via videoconferencing software. These profiles are organized by geographic region. These city profiles offer valuable insights into distinct challenges, opportunities, solutions, and aspirations from the perspectives of city officials. They highlight the varied strategies cities are already employing to enhance climate and health resilience. As field tested examples, they provide a foundation for innovative, scalable solutions to climate and health challenges across cities, nations, and regions.

Addis Ababa

ETHIOPIA, AFRICA

Climate-Related Stresses, City Challenges and Emerging Health Concerns

Climate Change has led to reduced rainfall and increased variability in Addis Ababa. These conditions are expected to increase the period of extreme drought that the city faces annually. Heatwaves have become more frequent and intense. Many residents lack the technology or resources (e.g., air conditioning, heating, building insulation) to buffer the health impacts of heatwaves, including dehydration, heat stress, heatstroke, and exacerbation of other chronic conditions such as cardiovascular and respiratory diseases. When they do, the inconsistent energy supply limits effectiveness. Addis' old and highly polluting vehicle stock aggravates air contamination, with wide-ranging adverse effects on health, such as exacerbating respiratory conditions such as asthma and tuberculosis. Carbon monoxide pollution is of particular concern.

Floods and their effects, including land degradation, soil erosion, water, and soil pollution, destroy livelihoods, property, and capital assets, damage municipal infrastructure such as sewage systems and roads, cause injury, impact mental health, and can cause or aggravate disease outbreaks. Poor waste management systems expose residents to different health issues. As highlighted in the Addis Ababa 2020 Resilience Strategy, water and sanitation are key issues. Only 44% of the population in Addis Ababa have access to clean water, and only 30% have access to sewerage systems. There were multiple cholera outbreaks last year across Ethiopia linked to water, sanitation, and hygiene issues. Therefore, waterborne diseases are a grave concern.

Although there are some data collected by the government, there is no centralized database The government often relies on projections and models rather than valid or reliable sources of data. For example, while the census should be conducted every 10 years, it hasn't been done since 2007. As such, the city faces difficulties assessing socioeconomic vulnerability factors to climate and health challenges. Research is only beginning to emerge in Addis Ababa to attribute health outcomes to climate stresses.

Addressing the Challenges

Addis Ababa has started taking steps to address these climate and health challenges through various initiatives:

CLIMATE ACTION PLANNING AND COMMUNITY ENGAGEMENT

- **Climate Action Plan (CAP):** Developed in collaboration with the C40, the CAP focuses on both mitigation and adaptation strategies to build a sustainable, emissions-neutral, and resilient city by 2050. This plan outlines actions to reduce greenhouse gas emissions from sectors such as waste, energy, buildings, industry, and transport while enhancing the city's resilience to climate impacts.
- **Community-Level Adaptation:** Promoting autonomous adaptation at the community level involves educating and empowering local communities to implement climate-resilient practices. This includes initiatives like smart agriculture and urban farming to enhance food security and resilience to climate impacts.

STRENGTHEN CITY SYSTEMS

- **Tree Planting and Urban Greening:** The city has undertaken extensive tree planting campaigns and the Sheger Beautification Project to increase green spaces, which help mitigate heatwaves, reduce air pollution, and improve overall urban resilience.
- **Development of Public Transport Systems:** Addis Ababa is enhancing its public transportation infrastructure, including the development of the Light Rail Transit (LRT) system and the ongoing construction of the Bus Rapid Transit (BRT) syst\em. These initiatives aim to reduce reliance on old, polluting vehicles, thus improving air quality and reducing greenhouse gas emissions.
- **Promotion of Non-Motorized Transport:** Initiatives such as car-free days and the promotion of walking and cycling aim to reduce traffic congestion, decrease pollution, and encourage healthier lifestyles among residents.
- **Air Quality Management:** The development of an Air Quality Management Plan (AQMP) is a significant step towards addressing air pollution. The plan includes measures to monitor and improve air quality, focusing on reducing emissions from key sources such as transportation and industry.
- **Waste Management Improvements:** The city is working on enhancing its waste management systems, including the construction of composting facilities, improving landfill management, and installing gas capture facilities to reduce emissions from waste.
- **Water and Sanitation Projects:** Efforts are ongoing to improve access to clean water and develop sewage systems, thereby reducing the incidence of waterborne diseases and improving public health outcomes.

Cape Town

SOUTH AFRICA, AFRICA

Climate-Related Stresses, City Challenges and Emerging Health Concerns

A key climate-related stress in Cape Town is drought, with both hydrological and meteorological causes. Having experienced three years of rainfall deficit, in early 2018, Cape Town was bracing for "Day Zero" – with concerns about being the first city to run out of water.[77] Although this crisis was averted, vulnerabilities still remain. Additional climate-related stresses include increased fires linked to drought, extreme heat, urban sprawl, and vegetation. They are also concerned about Additional flooding during seasonal storms, storm surges, and changing coastlines.

Cape Town is concerned about high heat days and heatwaves, as such, they have established a Heat Action Plan to increase preparedness by strengthening early warning systems.[78] Heat is experienced differently across communities in Cape Town depending on socio-economic factors and urban structure. For example, communities living in informal settlements and housing are particularly vulnerable to higher indoor temperatures and face an increased risk of fires.

Mental health issues are also of concern in Cape Town. Though it is a challenge to draw empirical linkages to exposure to climatic conditions, the pathways are well established in the literature. Currently, studies with academic partners in Cape Town are ongoing to understand climate exposure and the impact on the mental health of mothers in vulnerable communities. The city anticipates increased mental health challenges ranging from anxiety and depression to psychotic illnesses that will likely be exacerbated or triggered by climate stresses like heat. Cape Town's 2018 Resilience Strategy emphasized concerns related to mental health and violence.[79] These are underlying vulnerabilities exacerbated by poverty undergirding climate-related vulnerabilities.

Addressing the Challenges

EVIDENCE TO ACTION

- **Data Portals (providing different levels of access):** Cape Town has an open data portal (capetown.gov.za/City-Connect/All-City-online-services/open-data-portal/) with a wide range of aggregated datasets accessible to the general public. Using this portal, it is also possible to request access to administrative datasets. Access is facilitated through an internal data platform, which allows registered individuals access to specific datasets.
- **City-level Databases (household level survey):** Cape Town has recently begun conducting its own large scale socio-economic household survey with the aim of developing a profile for every suburb of Cape Town. The survey will be conducted every two years. This will allow the city to gain up to date data at the household level between national censuses, which are conducted every 10 years. The survey will provide a means for tracking a multitude of socio-economic metrics relevant to the design of city programs and service delivery and outcome and impact level evaluation of city programs.
- **Vulnerability Viewer:** Notably, Cape Town has a local-level "vulnerability viewer" that includes several indicators (income, spatial distribution, access to services, etc.). The tool uses census data from 2011, and a 2023 iteration is in development. This "viewer" is for internal use only but there are plans to make some components public.
- **Health-Related Databases:** Cape Town has a primary healthcare database called Prehmis, which captures specific components of patient level care for each service rendered. Using this database, the city has individual-level access to primary health care data for each beneficiary. Additionally, the city has access to the Single Patient Viewer, a data system run by the Provincial Health Data Center, which integrates data from all the public sector data systems to create a consolidated patient record. Access to data in this format allows service providers to uncover gaps in the care cascade for a multitude of health conditions. Currently, city's Environmental Health data are not digitized in a routine system, which represents a critical limitation. The National Department of Forestry, Fisheries and the Environment has the South African Air Quality Information System dashboard. However, this database is dependent on the quality of the stations and the functionality of the air quality sensors.
- **Health-related Research:** Cape Town has an established collaborative research and implementation partnerships with various academic institutions within the province (University of Cape Town, Stellenbosch University, University of the Western Cape) and with district support partners such as Desmond Tutu TB Center and HIV Foundation, Anova, and Aurrum. Questions regarding the intersectionality of health and climate that are being investigated by these institutions are addressed in collaboration with the City of Cape Town. Specifically, University of Cape Town and Stellenbosch University have several research projects that examine the impact of climate change on health; results are being shared among government stakeholders, those involved in the provision of public health services, and others more broadly.

- **Horizon scanning exercise in support of long-term plan for Cape Town:** This exercise entailed systematically gathering, analyzing, and interpreting data to anticipate future trends, challenges, and opportunities that may impact Cape Town's long-term planning outcomes. The exercise focused on proactively identifying emerging issues, technological advancements, policy changes, and socioeconomic shifts to better inform the refinement process of the long-term plan and the city's land use model.
- **Scenario planning in development of long-term strategies:** Cape Town is building internal capabilities to conduct scenario planning in support of strategies that have a 20-year and beyond time horizon. In the last two years, scenario planning processes have been conducted as part of the city's transport and energy strategy development as well as the city's long-term plan. The city recognized the importance of identifying relevant metrics to track the factors and critical uncertainties key to city priorities, and prioritized trend analysis and quantitative scenario building to inform decisions. In 2023, the city commissioned the development of a methodology for combining and comparing information, addressing assumptions and limitations, and reviewing outputs to inform strategic responses and long-term planning. This methodology included data mapping, tracking key considerations, and utilizing a classification schema for qualitative and quantitative data.
- **Collaboration with Institute of Futures Research (Stellenbosch University):** This partnership has afforded the city training in horizon scanning and various techniques for identifying current and future trends and uncertainties and key assumptions linked to the city's functions. Insights from the Institute for Futures Research into methodological approaches and global best practice has been very valuable, providing the city with the tools and impetus to mature its approach to future planning.

LAGOS

NIGERIA, AFRICA

Climate-Related Stresses, City Challenges and Emerging Health Concerns

Key climate-related stresses in Lagos include water scarcity and droughts, flooding (including both flash floods caused by rain that generally recede in 2-3 hours and more severe chronic flooding), coastal erosion, storm surge, and air pollution. These stresses have led to internal displacement, and infectious disease outbreaks in the Lagos Municipality. Additionally, the Lagos State Resilience Office (LASRO) has also prioritized addressing the adverse mental health impacts related to these climate-related stresses.

Health actions outlined in the Resilient Lagos strategy are predicated on building capacity in the health system. However, the shortage of medical professionals in the country represents a critical barrier outside of LASRO's scope. Other challenges include limited funding for climate and health initiatives. While the government has data on health systems (e.g., hospitals, medical professionals) and collects data on diseases, injuries, and mortality, there isn't any intersectoral engagement between the resilience department and health-related data. The Bureau of Statistics does not make data available to the public, and the collected data mostly pertains to economic and developmental indicators.

Addressing the Challenges

- **Climate Action Plan 2020-2025:** Lagos' Climate Action Plan 2020-2025, promoted by the Ministry of Environment and Water Resources, includes a net-zero goal by 2050 and focuses on both adaptation and mitigation. This comprehensive plan aims to address the various climate-related stresses by implementing strategies that enhance the city's resilience and sustainability. The adaptation component includes measures to improve water management, enhance flood control systems, and

reduce the heat island effect in urban areas. These measures directly impact health by ensuring safer water supplies, reducing the risk of water-borne diseases, and mitigating heat-related health issues. LASRO is also promoting private partnerships to implement its Climate Action Plan. They emphasized there are "never enough partners" and that the work they have done with the Climate Action Plan and the Lagos Resilience Strategy has been in partnership with organizations including the University of Lagos, the Slum Dwellers Association of Nigeria, Resilient Cities Network, C40, and Boston Consulting Group.

- **Ajegunle-Ikorodu Community Resilience Action Plan:** Building resilience at the local level is key to ensuring that ensuing benefits are equitable. To this end, LASRO supported efforts to launch a pilot project culminating in the Ajegunle-Ikorodu Community Resilience Action Plan in collaboration with University of Lagos.[80] This plan focuses on local-level interventions to build community resilience against climate-related impacts, ensuring that vulnerable populations are better prepared and protected. Given the success in Ajegunle-Ikorodu, these efforts will be replicated and scaled up. LASRO hopes to conduct more community-level Community Resilience Action Plans to address the heterogeneity in impacts and response capability to shocks and stresses at the local level.

Highlighted Key Initiatives within the Ajegunle-Ikorodu Community Resilience Action Plan

WATER MANAGEMENT

- **Baseline Study for Potable Water:** A baseline study will ascertain the best locations to source potable water within and around the community. This initiative aims to provide a roadmap for systematically increasing access to water supply for residents, reducing the consumption of unsafe water, and lowering the incidence of water-borne diseases. By improving water quality, the community reduces the prevalence of illnesses such as cholera and diarrhea, directly linking water management to health outcomes.
- **Installation of Purification Systems:** Existing public boreholes will be upgraded with water purification systems to improve water quality. This initiative is expected to reduce the number of cases of illnesses associated with water-borne diseases and increase the number of households with access to safe water. Safe water access is crucial for preventing diseases, ensuring better health for all community members.
- **Channeling Potable Water:** Efforts will be made to engage the Water Corporation to channel potable water from waterworks into the community, ensuring a more reliable and higher quality water supply. This will lower household expenditure on water and improve public health outcomes. Access to clean water is essential for maintaining hygiene and preventing disease outbreaks.

INFRASTRUCTURE DEVELOPMENT

- **Road and Drainage Upgrades:** Existing bad roads and drainage channels will be upgraded to reduce flooding and improve mobility.

This includes clearing and widening drainage channels to expand their capacity and upgrading all existing roads to better withstand flood events. Improved infrastructure reduces the health risks associated with flooding, such as injuries, water contamination, and vector-borne diseases.

HEALTH AND SAFETY INITIATIVES

- **Improving Health Infrastructure:** Expanding the capacity of the existing health center and constructing new facilities to provide comprehensive maternal and pediatric services. This will address the current insufficiencies and ensure better health outcomes for residents. Enhanced health infrastructure directly improves the community's ability to respond to climate-related health issues, ensuring better care during extreme weather events.

SEMARANG

INDONESIA, ASIA-PACIFIC

Climate-Related Stresses, City Challenges and Emerging Health Concerns

In recent years, Semarang City has experienced firsthand the profound impacts of climate change. Rising temperatures and shifting weather patterns impact many aspects of its surroundings, notably health and well-being. Located on the coast, Semarang City faces multiple threats of sea level rise, increased surface temperature, and extreme rainfalls, which lead to more frequent flooding and erosion along the shores. These events have become significant infrastructure, economic, and community risks.

The effects of climate change are not confined to environmental concerns alone. They also affect public health and urban planning and policymaking. Vulnerable neighborhoods and marginalized populations often bear the brunt of these impacts, underscoring the need for inclusive and adaptive strategies.

Addressing the Challenges

INTEGRATIVE HEALTH MONITORING

- **Health Monitoring Systems:** Semarang has established robust monitoring systems to track health outcomes associated with climate variables. This system utilizes real-time data collection from local health centers (Puskesmas) and hospitals, which is then analyzed to identify trends and potential outbreaks. By tracking these variables, the city can respond quickly to health crises exacerbated by climate conditions, such as heatwaves or flooding-related diseases, ensuring timely medical interventions and resource allocation.
- **Climate Health Impact Studies:** The city conducts specific studies to understand how temperature fluctuations, humidity, and air quality affect health. This includes looking at direct impacts like heat strokes and indirect effects such as increased prevalence of respiratory or cardiovascular diseases during extreme weather events. These studies

inform public health policies and help in the development of targeted health advisories and interventions, directly linking climate data with health outcomes to protect vulnerable populations.

DATA-DRIVEN INTERVENTIONS

- **Mapping Vulnerabilities:** Detailed Geographic Information System (GIS) mapping is used to pinpoint areas with higher health risks due to climate impacts. This data guides the allocation of resources, such as deploying mobile health units or intensifying disease surveillance in high-risk areas. By identifying the most affected areas, the city can prioritize efforts to safeguard the health of those most vulnerable to climate-induced health issues, ensuring equity in health resource distribution.
- **Preventative Measures and Public Education:** The city has launched public education campaigns focusing on preventative measures people can take during heatwaves or other extreme weather events. These campaigns aim to increase awareness about the health risks associated with climate change and educate residents on how to mitigate these risks through simple actions such as staying hydrated, seeking cool shelters, and monitoring air quality. Public education empowers communities with knowledge, helping them to take proactive steps to protect their health and well-being.

EQUITY-FOCUSED ADAPTATIONS

- **Inclusive Health Services:** Ensuring that health services are accessible to all, especially marginalized and vulnerable communities, is a priority. Mobile health units and community health workers are deployed to areas with limited access to healthcare facilities, providing essential health services and climate-related health education. This approach ensures that all residents, regardless of their socio-economic status, receive the necessary care and information to manage health risks associated with climate change.
- **Community Resilience Building:** Engaging local communities in resilience-building activities, such as clean-up drives, tree planting, and local climate adaptation projects, fosters a sense of ownership and empowerment. These activities not only improve the local environment but also enhance community cohesion and resilience, making residents better prepared to handle climate-related health challenges collectively.

VECTOR-BORNE DISEASE MANAGEMENT

- **Dengue Hemorrhagic Fever (DHF) Management:** Semarang has faced significant challenges with DHF, exacerbated by climate factors such as increased humidity and changing temperatures. The city has implemented a comprehensive approach to manage DHF, including:
  - **Risk Mapping and Impact Prediction:** Using data on climate factors, population density, and health service access, Semarang conducts risk mapping to identify high-risk areas for DHF outbreaks. This data-driven approach allows for focused interventions in the most affected areas.
  - **Health Surveillance System:** A robust health surveillance system tracks DHF cases and vector behavior, enabling early detection and rapid response to outbreaks. This system includes the deployment of health surveillance personnel (Gasurkes) and community-based inspections (PJN) to monitor and control mosquito populations.

- **Public Education and Community Involvement:** Education campaigns on the signs and symptoms of DHF and the importance of preventive measures, such as using mosquito nets and eliminating standing water, have been implemented. Community involvement in vector control activities, such as the One House One Larvae Inspector movement, enhances the effectiveness of these measures.
- **Innovative Solutions:** Semarang has introduced the use of Wolbachia-infected mosquitoes, a biological control method that reduces the ability of mosquitoes to transmit dengue. This innovative approach has shown promising results in reducing DHF cases and hospitalizations.

SURAT

INDIA, ASIA-PACIFIC

Climate-Related Stresses, City Challenges and Emerging Health Concerns

Surat has faced substantial climate-related stresses, including rising temperatures, increasing air pollution, heightened humidity levels, and flooding. While major river floods have not occurred since 2012, the city continues to grapple with its dual location on the riverbank and near the seashore, combined with a dense industrial presence, which poses ongoing environmental challenges.

Rapid industrialization led to a significant surge in migration, with migrants constituting approximately 60% of the population. Rapid population growth has led to high concentrations of migrants in slums. Consequently, there has been a shift in the health profile of the city, including a rise in non-communicable diseases such as diabetes and mental health issues. The interviewee also noted increased reports of dog bite cases attributed to climate change affecting animal behavior.

The integration of efforts across different sectors to address climate change and public health remains a substantial challenge in Surat. While the city has implemented initiatives like public transport systems, tree planting drives, industrial water recycling initiatives, and solar panel installations, the convergence of health and engineering sectors during non-emergency periods is weak.

Addressing the Challenges

VECTOR-BORNE DISEASE MANAGEMENT

- **Household-Level Monitoring:** Surat has established dedicated squads of community outreach workers to actively control vector-borne diseases like filariasis and malaria, which were historically prevalent. The city employs about 600 workers who conduct house-to-house visits to control these diseases. Regular monitoring and prompt interventions help prevent the spread of these diseases, linking climate adaptation directly to health outcomes.

CLIMATE ADAPTATION AND MITIGATION

- **Public Transport Systems:** To reduce air pollution and mitigate the urban heat island effect, Surat has enhanced its public transportation network. This initiative not only lowers greenhouse gas emissions but also improves air quality, thereby reducing respiratory and cardiovascular health issues linked to pollution.
- **Tree Plantation Drives:** Extensive tree planting campaigns have been conducted to increase green cover in the city. Trees help in lowering temperatures, improving air quality, and providing shade, which reduces the impact of heatwaves on public health. Increased green spaces also promote mental well-being among residents.
- **Industrial Water Recycling Initiatives:** Industries in Surat are encouraged to adopt water recycling technologies to reduce water scarcity and ensure sustainable water management. This initiative helps maintain water quality and availability, essential for preventing water-borne diseases.
- **Solar Panel Installations:** The promotion of solar energy reduces reliance on fossil fuels, thereby decreasing air pollution. Clean energy initiatives improve overall air quality, reducing the incidence of respiratory diseases and other health issues related to pollution.

EQUITY-FOCUSED ADAPTATIONS

- **Inclusive Health Services:** Ensuring that health services are accessible to all, especially migrants and marginalized communities, is a priority. Health camps and mobile clinics are set up in slum areas to provide medical care and health education. This approach ensures that vulnerable populations receive the necessary care to manage health risks associated with climate change.
- **Community Resilience Building:** Engaging local communities in resilience-building activities, such as clean-up drives, health awareness programs, and local climate adaptation projects, fosters a sense of ownership and empowerment. These activities improve community cohesion and resilience, making residents better prepared to handle climate-related health challenges collectively.

Urban Health & Climate Resilience Center Initiative

The Urban Health & Climate Resilience Center was established to emphasize evidence-based advocacy to local self-government and demonstrate unique models of capacity building for various city stakeholders. From 2013 to 2016, the project focused on interdisciplinary research, training, advocacy, and network building. It was the first of its kind in India, under the execution of the health department of Surat Municipal Corporation . The seed funding for the project was provided by the Asian Cities Climate Change Resilience Network of the Rockefeller Foundation. Key actions taken by the Urban Health & Climate Resilience Center included:

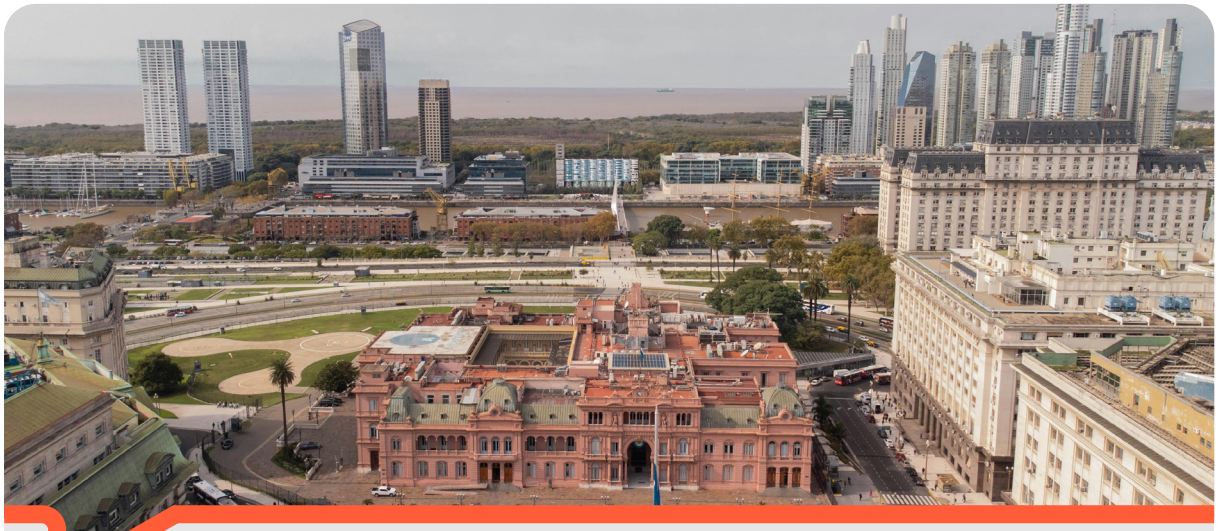
- **Urban Climate and Health Vulnerability Assessment:** Conducted at multiple levels, including municipal corporations of Gujarat, administrative zones of Surat city, census wards, and sample slums. This assessment examined vulnerability and resilience through socio-demographic, climate, and public health dimensions.
- **Heat & Health Action Plan:** Developed based on evidence linking heat, humidity, and health outcomes, the Heat and Health Action Plan was piloted in 2016, making Surat the first coastal city in India to implement such a plan.
- **Advocacy for Strengthening Disease Surveillance:** Documentation of disease surveillance during routine and disaster periods, providing valuable insights into effective health monitoring and management practices.
- **Community Resilience Action Models:** Multiple models were developed, including Surat Arogya Samvad (community health dialogue forum), Healthy Surat Working Group, Climate Smart Healthy Children (peer educators' program), Surat Alliance for Urban Agriculture & Resilience , and community-based climate and health surveillance.

Principles Adapted by the Urban Health & Climate Resilience Center in Resilience Leadership include:

Convergence & Formalizing Partnerships – Bringing different stakeholders together to strengthen partnerships during routine and disaster periods;

Evidence-Based Actions – Generating a systematic evidence base for urban resilience actions, crucial for informed decision-making; and Understanding;

Cultural Context & Sharing-Learning – Integrating local culture and practices into resilience strategies and promoting shared learning among stakeholders.



BUENOS AIRES

ARGENTINA, LATIN AMERICA AND THE CARIBBEAN

Climate-Related Stresses, City Challenges and Emerging Health Concerns

Recently, Buenos Aires experienced two unusually severe storms. While the city had prepared for flooding, it did not adequately plan for other associated issues such as falling trees and impacts on infrastructure and housing. Additionally, heatwaves are increasing in frequency, intensity, and duration, posing significant health risks to the population.

The city faces a growing challenge with the acceleration of the Dengue epidemic. Previously, Dengue was deprioritized due to the dry climate, but with changing climate patterns, it has become a pressing health issue. Addressing the cross-cutting nature of climate change remains a significant challenge, and there is a need for integrating climate change perspectives into government projects.

Integration with the metropolitan area beyond Buenos Aires, despite functional and political differences, is being prioritized. Buenos Aires has three million residents, and another three million enter daily for work, school, social, cultural or retail activities, necessitating a comprehensive approach to a cross-sectoral agenda. This includes education and raising awareness of climate impacts on health.

The city is also addressing significant challenges related to data management and processing. Many claim that the national census is unreliable, undermining confidence in the data. Moreover, meteorological data for the city is sourced from only two meteorological stations. As such, efforts to analyze temperature characteristics in informal settlements and other vulnerable areas are hindered by insufficient and inadequate climatic and census information. The city also faces difficulties accessing and managing data from external sources. There are currently no systematic data-driven evaluations of projected impacts of climate on health in Buenos Aires.

Addressing the Challenges

DATA MANAGEMENT AND SURVEILLANCE

- Buenos Aires takes multiple approaches to finding data and information on risks that the city might face in the future. For instance, climate data are sourced from the National Meteorological Service. Researchers conduct and share numerous analyses regarding future temperature scenarios with city officials. Although some data are lacking, they believe they have a significant foundation.
- The city government maintains a reliable statistics and census department. They are actively involved in various research projects, often invited due to their understanding and adept use of data. They are associated with a monitoring project with NASA, which includes information on heat islands within 100m x 100m grids.
- Through a project funded by the German Government, they deployed 10 thermometers distinct from those used by the Meteorological Service. These thermometers measure air temperature in vulnerable neighborhoods, both with and without vegetation.
- They seek to assess the impact of urban green infrastructure on temperature reduction or regulation to provide evidence for decision-makers. Residents are responsible for monitoring the thermometers. However, challenges arise from the occasional theft of thermometer parts.

CLIMATE ADAPTATION AND MITIGATION ACTIONS

- **Heat Plan:** Initial investigations are underway regarding the relationship between climate change, heatwaves, and health. The city is developing of a Heat Plan, which will have a strong focus on heat and health.
- **Extreme Climate Events Adaptation Program.** This program aims to prevent negative impacts resulting from high temperatures, particularly the effects of heatwaves on the elderly. To achieve this, the following actions are taken:
  - Communication through WhatsApp groups, and social media providing information and advice on heat waves to the elderly.
  - Awareness and prevention workshops on heatwaves: Meetings with the elderly provide information on global warming and its impacts, along with preventive measures to deal with heatwaves. Participants are encouraged to share their experiences regarding observed climate changes throughout their lives. These workshops, conducted annually between December and March, are coordinated with various departments of the Buenos Aires City Government, which implement specific programs targeting the elderly.

INTEGRATIVE HEALTH MONITORING

- **WHO Heatwave Analysis Project.** Implemented in specific hospitals to study the relationship between deaths and illnesses and heatwaves. This project aims to establish a mandatory reporting system for heat related death and illness. Its objective is to analyze the prevalence and

risk of diseases and deaths associated with heatwaves, generating a registration system akin to the existing one for dengue fever. Dengue fever requires mandatory reporting of fatalities, residence, travel history, etc. A similar reporting system is proposed for heat waves through a protocol for hospitals and medical professionals.

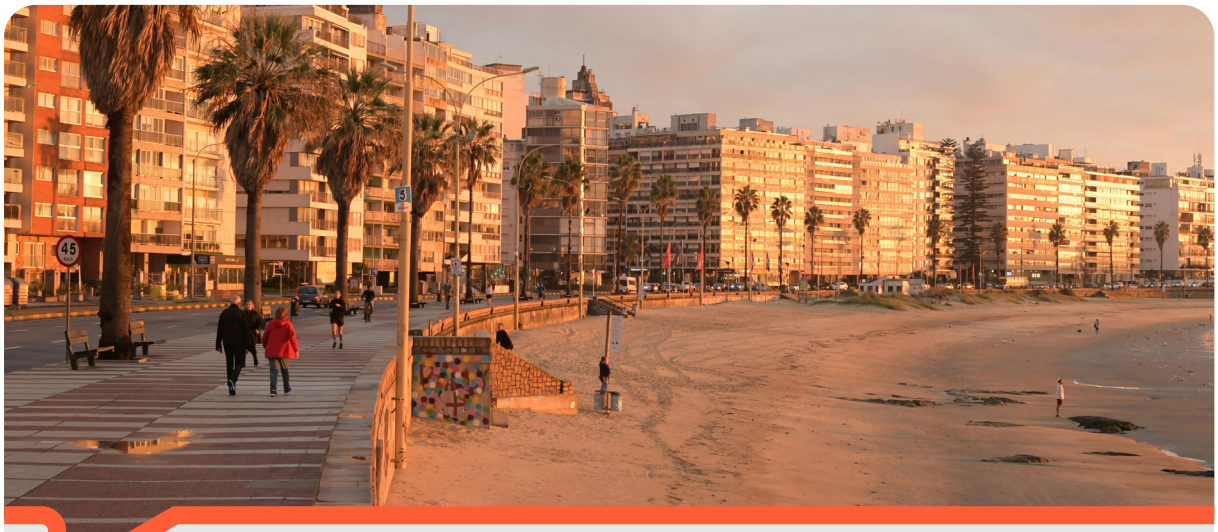
- **Heatwave Illness Registration Protocol:** This protocol will structure recording processes of heat-related illness in collaboration with medical professionals and hospitals, integrating it with heat risk maps.
- **Mandatory Dengue Registration:** There is a wealth of data tracking the incidence and impacts of Dengue due to its status as a disease of mandatory registration.

GREENING INITIATIVES

- **Ecoparque.** Ecoparque serves as a gateway to Argentina's biodiversity, aiming to help visitors understand the importance of conserving our species and to familiarize them with the conservation programs operating within the park. It seeks to revalue cultural and natural heritage through interactive learning experiences in direct contact with nature. It also serves as an important green space for exercise.

LOCAL PARTNERSHIPS AND COLLABORATION

- **Climate Change Cabinet.** This cabinet is composed of all department heads of ministries in Buenos Aires to discuss the climate agenda, including policies, challenges, and proposed actions. It comprehensively addresses climate change issues and involves the participation of environmental agencies and the Ministry of Health.



MONTEVIDEO

URUGUAY, LATIN AMERICA AND THE CARIBBEAN

Climate-Related Stresses, City Challenges and Emerging Health Concerns

In the past year, Montevideo has faced significant challenges related to vector-borne diseases, particularly those transmitted by mosquitoes. The endemic circulation of arboviruses has gradually appeared in the eastern region of the country, including the emergence of the equine encephalitis virus. With climate change, the incidence of floods and droughts has increased. Although urban areas of Montevideo generally do not experience immediate impacts, arboviruses such as Dengue, Zika, and Chikungunya have become established in the region, a shift from Uruguay's previous relative freedom from these diseases.

Constant emergencies and urgent demands have pushed the development of a strategic linkage between conceptual understanding and action to the background. There has been a lack of opportunity to reflect and plan, particularly from a perspective on risks associated with climate change and health impacts.

Substantial challenges persist at the municipal level due to the lack of unified information systems. Although much of the national-level data are generated by the Municipality of Montevideo, overall data for the nation is fragmented. There is a pressing need to automate data collection processes, as compiling and constructing these datasets is often done by hand.

Addressing the Challenges

DATA-DRIVEN INTERVENTIONS

- **Data Management:** Montevideo has made significant progress in data management by emphasizing data transparency and integration for both citizens and government officials across different sectors to support collaborative decision-making. The Data Observatory (https://montevidata.montevideo.gub.uy/) serves as an open portal for citizen access and information, aimed at generating transparency in government operations and aiding government decision-making. Comprising six individual data observatories—environment, health, mobility, culture, tourism, and urbanism—the observatories are regularly updated, with real-time updates in some cases. These data are crucial for executing municipal actions and facilitating intersectoral decision-making. The observatory also serves as an early warning system for the population.
- **Data Committee:** The Data Committee prioritizes evidence-based management across all government sectors, operating with a cross-cutting focus on ensuring the security, reliability, integrity, documentation, administration, and auditing of data. This guarantees the effective management of all processes required for evidence-based management.

EMERGENCY RESPONSE AND RESOURCE ALLOCATION

- **Flood Risk Analysis for Early Warning:** The city has conducted studies on flood-prone areas to issue targeted warnings to at-risk population groups. It prioritizes intervention zones based on socioeconomic characteristics of the population and the probability of risk, utilizing data such as hourly rainfall measurements to model flood risk. Leveraging its network of rain gauges for monitoring, data collection, and forecasting, the city has mapped urban zones based on high, medium, and low flood risk levels. An early warning system issued by the National Meteorological Institute complements these efforts.
- **Actions Against Floods:** Following the 2021-2022 floods that affected many vulnerable groups, Montevideo has begun revising its immediate response procedures in both health and material support to help people return to their homes. This support extended beyond immediate response, resulting in the launch of an intersectional working group. This group has fostered collaborations between different sectors and departments, including Social Development, Environmental Development, and the Departmental Emergency Coordination Center. Their focus areas include waste management, connections to water courses, risk zone assessment, and emergency communication mechanisms. Additionally, campaigns are being developed to raise awareness about certain risks, disseminate meteorological alerts, and enable the population to quickly notify the municipality of issues.
- **Actions to Address Heatwaves and Wildfires:** In recent years, heatwaves and forest fires have increased. To improve fire management practices and contribute to risk prevention in Montevideo's natural areas, the Executive Unit for Resilience (UER) of the Planning Department, together with the Departmental Emergency Coordination Centers and the

directors of the main parks in Montevideo, have designed an action, recording, and fire prevention protocol. Throughout this process, health priorities and urban health vulnerabilities due to wildfires have been prioritized.

CLIMATE ADAPTATION AND MITIGATION ACTIONS

- **Comprehensive Risk Management Plan and Climate Action Plan:** Created by inter-institutional working groups through public consultation, these plans devise strategies to address future climate scenarios and mitigate risk. Health has been incorporated as a workstream within these plans through the participation of the specific sector. Health-related impacts considered include vector-borne diseases, respiratory illnesses, the national water emergency, and the impact of floods, with a focus on vulnerable groups and projected risk scenarios.

PORTO ALEGRE

BRAZIL, LATIN AMERICA AND THE CARIBBEAN

Climate-Related Stresses, City Challenges and Emerging Health Concerns

Porto Alegre suffers from both extremes of climate – heavy rains and storms, as well as heatwaves and droughts. In 2023, the city experienced the largest floods in 80 years, resulting in three emergency decrees. A state of emergency was declared in early 2024 due to drought, directly affecting producers. In 2020, a similar declaration supported rural area producers to protect against production loss. Storms and rains generate winds, floods, and landslides, posing significant challenges, especially during the winter. Strong winds of up to 140 km/h in January left the city without water and electricity.

Rio Grande do Sul, including Porto Alegre, is currently experiencing a tragic flood with more than 160,000 people displaced and more than 100 deaths within and outside the city. A report from the Geological Service of Brazil identifies 142 high- and very high-risk areas for floods, landslides, and strong winds.

The use of pesticides in rural areas of the city contaminates the air, water, and agriculture, posing a threat to food security. Pollution in the transportation system remains a critical issue impacting the environment and public health. Additionally, vector-borne diseases, including Dengue, Zika, and Chikungunya, prompted Porto Alegre to declare a state of emergency.

Addressing the Challenges

CLIMATE ADAPTATION AND MITIGATION ACTIONS

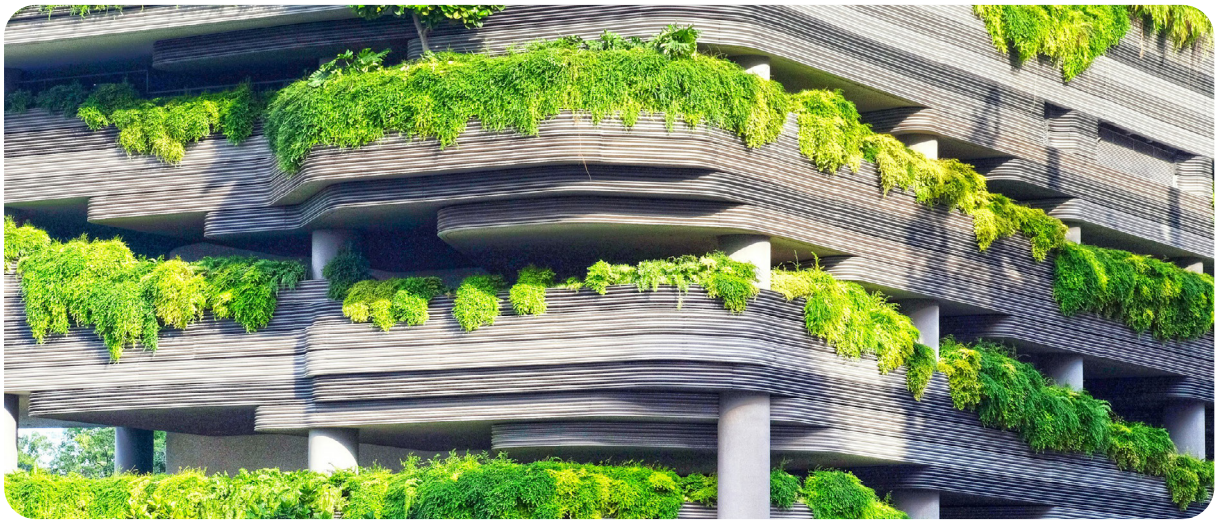
- **Climate Action Plan:** Porto Alegre has partnered with the Federal University of Rio Grande do Sul to develop a comprehensive Climate Action Plan. This plan includes surveillance for climate data and associated health impacts and collaborates with federal geological services to map high-risk areas in the city.
- **Municipal Sustainable Rural Development Plan:** This integrative plan allocates R$10.3 million BRL for promoting, assisting, and supporting rural producers. Its objectives include reducing pollution and pesticide use, improving food security, and addressing public health issues in the city.
- **Sustainable Logistics Plan:** Porto Alegre is the first municipal administration in the country to implement a Sustainable Logistics Plan. Actions include waste management, combating waste, improving energy efficiency, reducing water consumption, sustainable public works, and environmental education. These measures mitigate carbon emissions and pollution, generating co-benefits for health.
- **Municipal Disaster Risk Reduction Plan:** Developed in partnership with the Federal University of Rio Grande do Sul, this plan categorizes and analyzes risk areas facing extreme climatic phenomena and transmissible diseases.

DATA MANAGEMENT AND SURVEILLANCE

- **Internal and External Databases:** The city maintains internal databases for exclusive use by employees and a municipal database accessible to the public. There is extensive arbovirus health data, particularly focusing on Dengue, and ample meteorological data. These integrated data support decision-making within permanent committees.

LOCAL PARTNERSHIPS AND COLLABORATION

- **Permanent Emergency Action Committee:** Responsible for coordinating efforts and institutional collaboration through a cross-cutting and systemic management model. The committee aims to reduce response time to communities affected by disasters and increase the efficiency of interagency actions. It includes participation from the mayor and high-ranking government officials from departments such as governance, health, environment, resilience coordination, and housing authorities. The committee has successfully declared emergencies due to droughts, floods, and disease outbreaks, including Dengue proliferation.
- **Permanent Resilience Committee:** This committee increases the city's capacity for recovery and adaptation to abrupt changes, risk prevention, and disaster situations. It plans future resilience actions and updates the resilience strategy, involving staff from various departments, including governance, security, environment, urban planning, infrastructure, health, urban mobility, and social development. The committee works across departments to classify and unify initiatives. Formed to project impacts until 2030 and identify future challenges, this committee studies the necessary methods and actions to achieve the 2030 goals. The ongoing update of the resilience strategy also considers current and projected climate impacts on health.



Conclusion and Call to Action: Uniting for Urban Resilience

RECOMMENDATION 10:
Call to action

Create groundbreaking strategies to build urban resilience. City leaders must formulate an ambitious and holistic approach to address the intertwined challenges of climate, health and equity – sparking innovation, multi-sector collaboration, and new market opportunities. Together, we can create robust and sustainable solutions.

As cities worldwide grapple with the intertwined challenges of climate change, health, and equity, decisive actions are imperative for building a sustainable future. Results from the 2024 Urban Pulse survey and interviews underscore the urgent need for integrated solutions.

Summary of Findings

The 2024 Urban Pulse surveys and stakeholder interviews highlight that cities are facing severe climate threats such as extreme heat, flooding and air pollution. City leaders recognize the consequent threats that climate change poses for health; however, they also report that they are only modestly prepared. For example, fewer than one in three cities have a Climate Resilience Plan or other tool that integrates climate and health in their emergency preparedness and response. Moreover, collaboration often is limited between city departments and across multiple public, private and non-profit sectors. City leaders report that health systems and data surveillance systems in cities typically are under-resourced – also contributing to a fragmented response to climate-health crises.

Despite these challenges, many cities report having implemented successful programs and policies for both mitigation and adaptation. They share vivid examples such as greening initiatives to reduce heat and air pollution, widescale immunizations for vulnerable

populations, and strengthening many city systems such as water, transportation and food. We identified numerous successful initiatives already implemented by cities around the world. Of course, every city is unique. Nonetheless, we must learn from one another – amplifying and scaling up the best solutions globally.

Dedicated Funding for New and Sustained Initiatives

To implement the ten recommendations drawn directly from the results of this mixed-methods research effort, public- and private-sector funding is essential. COP28 (December 2023) was the first COP meeting to have a dedicated focus on health. The COP28 UAE Declaration on Climate and Health was endorsed by 151 countries.[81] Health-specific climate action remains severely underfunded with only ~6% of adaptation funding and 0.5% of multilateral climate funding allocated to projects that protect or improve human health.[82] The United Nations Environment Programme estimates that LMICs require at least $11 billion in funding per year this decade to adapt to climate and health impacts and to increase the resilience of health systems.[83] Despite this need, only $1 billion was committed for climate and health at COP28, pointing to a gap of at least $10 billion annually in required funding to support countries in tackling issues at the nexus of climate, health and equity.[84]

Therefore, we call for investment in evidence-based and innovative solutions in cities where most people live and work, and where resources can be effectively distributed to areas most in need leading to measurable impact.

1. **Prioritize Funding:** Funders must prioritize and increase investments in projects that integrate climate, health, and equity. This includes driving forward the recommendations outlined in this report, while developing new financing models that prioritize rapid disbursement of funds to countries, cities and communities most vulnerable to the adverse effects of climate change.
2. **Support Capacity Development:** Provide technical assistance to cities, particularly those with limited resources. Conduct feasibility studies, helping cities prepare projects to be bankable and investment ready, and build capacity through equipping city officials with the knowledge and skills needed to develop projects worthy of further investment.
3. **Fund Research and Evaluation:** Support transdisciplinary research in cities that goes beyond documenting the known associations between climate and health to intervention studies that strive to improve planetary and human health. This means investing in randomized controlled trials and other rigorous approaches, including newer more nimble randomized hybrid designs; translational and dissemination studies; and cost-benefit analysis. This will ensure that innovations are evidence-based and can be amplified and scaled-up from city to city, and region to region.

Urban Pulse: Implementing Solutions at the Intersection of Climate, Health, and Equity

Although climate change is global, its consequences are felt most acutely at the local level, where people directly experience its effects. Cities, where the majority of people live, must be at the center of our efforts.[85]

Cities are systems, not silos. Therefore, we call for an integrated, multi-sector approach to advances our collective understanding of the impacts of climate on health, empowering us to meet the demands of today's interconnected world. We have an ethical responsibility to work together to identify and implement solutions that will promote urban resilience. Focusing on the fundamental principle of prevention in public health, we must address mitigation strategies as well as adaptation to assure a comprehensive response to the urgent and accelerating threats of climate change. Cities, especially in low- and middle-income nations have more limited resources and often fragile health infrastructures that limit their ability to prevent or respond to disasters effectively. Amidst these challenges, action at the intersection of climate and health offers potential for substantial co-benefits.

To further the recommendations outlined in this report, we propose the following next steps. Cities should conduct thorough assessments of climate-health vulnerabilities and adaptive capacities. They can then use these data to inform strategic planning and priorities, especially for the most vulnerable populations. City leaders should then formulate and implement inclusive, data-driven policies that address climate, health, and equity simultaneously. These should leverage scientific expertise and be driven by collaborative public consultations to ensure robust policy frameworks. Public and political engagement can be further enhanced through awareness campaigns, policy dialogues, and participatory planning. Cities must mobilize deep involvement of community members in decision-making, ensuring those most affected have a voice in shaping their own futures. We believe that a shared understanding of the health benefits of climate action can foster more widespread support and funding. Finally, successful local initiatives should be considered for broader implementation: scaling-up to diverse urban contexts by adapting for differences in social, cultural, and economic contexts. Promoting city-to-city collaborations will enable us to share best practices and drive collective action on a global scale.

The challenges we face are monumental, and so are the opportunities for transformative change. We must unite in a vision of urban resilience, harnessing our collective wisdom and strength to build a healthier, more equitable, and sustainable urban environment for all.

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