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

## Executive Summary

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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/middle-income 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.

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# 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.

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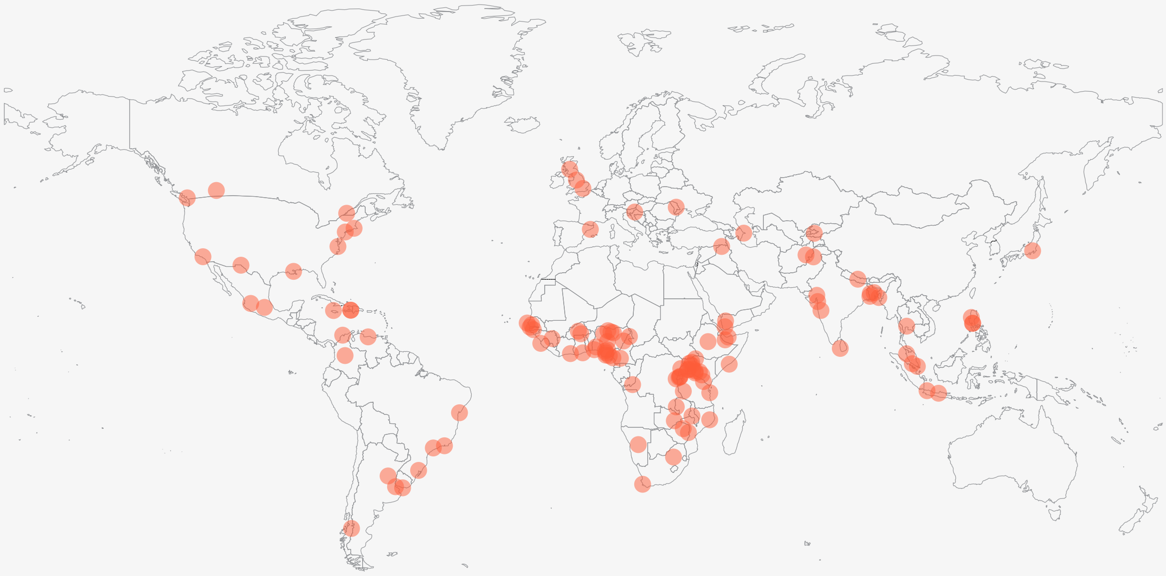
## Garnering Insights: 2024 Urban Pulse Surveys and Stakeholder Interviews

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, 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
Chişinău, 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 Interventions**

**Greening Initatives**

**Health-Related Interventions**

**Data Infrastructure and Disaster Management**

**Public Awareness and Community Engagement**

**Waste Management**

**Water Systems**

**Urban Planning & Transportation**

**Heat Mitigation**

**Food Systems**

**Clean Energy**

## 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, stressors, and exposures along with consequent health risks, 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.

3. **Place prevention and health promotion at the forefront of climate mitigation strategies.** Prioritize investments that will have the biggest impacts on health. 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 solutions that impact both climate and health; and, address the cost of *inaction*.

5. **Foster collaborative multi-sector public and political engagement on climate, health and equity.** Foster inclusive and proactive collaboration: policy dialogues, participatory planning, awareness campaigns to amplify climate-health messaging and drive action.

6. **Promote climate resilient & sustainable healthcare initiatives.** Cities must partner with healthcare providers and systems to reduce carbon emissions and promote health.

7. **Enhance data infrastructure and surveillance capabilities.** Integrate climate-health data systems and digitize to assure to improve preparedness and response readiness; use to inform long-term strategic decision making in cities.

8. **Foster city-to-city collaborations and knowledge exchange initiatives.** Partner with other cities to share best practices, provide support and innovate solutions.

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 are rigorously monitored for impact.

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.

1. **Prioritize Funding:** Prioritize and increase investments in projects that integrate climate, health, and equity; develop new financing models that prioritize rapid disbursement to cities most vulnerable to adverse impacts of climate change.

2. **Support Capacity Development:** Provide technical assistance, conduct feasibility studies, and build capacity through equipping city officials with 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.

## 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.