HERA

COUNTING THE COST OF HEAT: THE CASE FOR URGENT SOLUTIONS FOR CITIES

Summary Report

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Foreword

Kathy Baughman McLeod

> "When extreme heat undermines these women's health, safety, and income, the consequences are both devastating and do not stop with the individual."

Extreme heat has become one of the defining challenges of our time—and a growing threat to human health, economic productivity, and hope for shared prosperity. And yet, even as temperatures continue to shatter records and heat waves stretch longer each year, investment in solutions lags far behind what is needed to keep pace with heat's growing grip

This report provides the most comprehensive analysis to date on the impacts of extreme heat on women by integrating city-level climate projections, health and labor productivity modeling, gender-disaggregated economic analysis (including unpaid labor), and qualitative evidence from informal women workers. It quantifies what we at HERA see every day: extreme heat that magnifies existing social and economic inequalities, with women, especially those in the informal sector, facing the greatest exposure and least protection. When extreme heat undermines these women's health, safety, and income, the consequences are both devastating and do not stop with the individual. They ripple outward through families, local economies, and entire cities.

The analysis is accompanied by a new City Heat Solutions Calculator tool to help identify, prioritize, and finance heat adaptation investments. The tool provides a consistent framework for comparing the costs and benefits of interventions and designing portfolios that, when implemented, maximize social returns.

This report presents both the evidence and the case for action. The solutions exist, and many are remarkably cost-effective. Heat response plans, financial supports, labor protections, shade and cool roofs, urban greening, and innovative financial tools can save lives, protect precious income, and generate returns that far exceed their costs. The question is whether we're willing to invest at the scale and speed required. We hope this tool will help practitioners and decision makers meet the call.

—**Kathy Baughman McLeod**,

Chief Executive Officer, HERA

Executive Summary

Key findings

- Heat-related economic impacts are projected to intensify three- to five-fold by 2050 without adaptation
- Across Central & Southern Asia, Eastern & South-Eastern Asia, Sub-Saharan Africa, and Latin America & the Caribbean, informal women lose $57 billion per year in heat-related productivity loss. This is set to rise by 44% by 2050.
- Heat Response Plans offer excellent value for money, with returns of up to 90 times their cost.

A representative portfolio of low-cost interventions (including labor protections, heat insurance, urban green space, cool roofs, and a Heat Response Plan) could reduce heat-related mortality by 36%.

Extreme heat is emerging as a major threat to economic development worldwide. Heat harms physical and mental health, overwhelms healthcare systems, suppresses labor productivity, increases household debt, and slows long-term growth. Across four cities analyzed in this study – Ahmedabad, Bangkok, Monterrey, and Freetown – heat incurs annual economic losses worth as much as 4-8% of city GDP.[1] Without targeted action, these effects are expected to intensify three- to five-fold by 2050, driven by climate change, urbanization, and population ageing.[2]

The burden is not shared evenly – and women bear disproportionate risks and impacts. Extreme heat amplifies existing social and economic inequalities, with women, especially those working in the informal sector, facing heightened exposure and the least protection from its effects.[3] Women are more vulnerable to heat through a combination of compounding factors, including physiological sensitivity (especially during pregnancy[4]), economic insecurity (earning less income and holding fewer assets[5]), a heavier burden of unpaid care, norms that restrict clothing and movement, greater risk of gender-based violence, and more limited access to cooling, healthcare, social protection, and safe working conditions.

The impacts on women's health and finances are significant – and most acute for those in the informal sector, who lack protections that could otherwise mitigate their losses. Across Central & Southern Asia, Eastern & South-Eastern Asia, Sub-Saharan Africa, and Latin America & the Caribbean, informal women lose $57 billion per year in heat-related productivity loss (which represents 4-11% of their wages).[6]

[1] Economic impacts vary by city and region – this figure is from Bangkok.
[2] Study calculations compared to estimates from WHO (2021)
[3] United Nations (2024)
[4] Lakhoo et al. (2024)
[5] UN Women
[6] Based on a simple extrapolation of our work-loss estimates in representative cities to the regions they represent.

These individual losses do not stay individual—they leave long-term, city-wide economic scars. Heat-related productivity and income shocks ripple through local and national economies, compounding their effects: in Bangkok, labor productivity losses reduce the city's GDP by an average of 4% annually – the equivalent of the city government's budget[7] – or as much as 8% in an unusually hot year. In Freetown, extreme heat increases the average household debt-to-income ratio by 3% each year (6% in extreme heat years), crowding out investment in education and entrepreneurship, and dampening long-term growth. The long-term consequences of this are most pronounced when losses accrue to women, who invest up to 90% of their income back into their households: when their earnings fall, so does spending on children's education, nutrition, and healthcare.

Despite the scale of these risks, targeted, cost-effective action can make a substantial difference in vulnerable people's lives. A portfolio of low-cost urban heat interventions, including heat response plans, urban greening, cool roofs, and safe working regulations, could reduce heat-related mortality by more than 36% by 2050 in the cities analyzed. Well-designed measures deliver exceptional value for money: heat response plans generate returns between 12 and 90 times their cost. Cool roofs, green spaces, insurance, and labor protections also deliver benefits that outweigh their costs across contexts.

Maximum cost effectiveness relies upon interventions tailored to those who are most impacted. Heat solutions can be poorly aligned with the needs of the most vulnerable: early warning systems rely on phone ownership and literacy, cooling centers assume mobility and free time, and labor protections rarely reach the unregulated informal sector. Targeting interventions to address these gaps pays off: parametric insurance can reduce informal sector women's income losses, for example, by 40% in Monterrey by 2050.[8] Cities that invest in inclusive design protect their most exposed residents while also maximizing the return on every dollar spent.

This report is accompanied by practical resources for planners. These are:

- **a cost-benefit analysis tool** that enables policymakers and practitioners to compare interventions and explore heat adaptation investments that reduce risks and impacts, and access the long-term costs while delivering the greatest health and economic returns.

- **case studies of informal and shift women workers** across the four cities analyzed. These women's stories illustrate the importance of not only developing solutions that target those most impacted by extreme heat but also co-designing these solutions with them – grounding interventions in their lived experience and ensuring solutions reflect real-world impacts.

[7] Bangkok Post (2024)
[8] This refers to a parametric insurance scheme specifically designed (and available exclusively to) informal sector women (similar to the SEWA scheme).

Introduction

City, regional, and national leaders face a daunting array of challenges: revitalizing stagnant economies, strengthening public services, promoting health and wellbeing as populations age and chronic diseases rise, and addressing entrenched inequalities. Extreme heat compounds every one of these pressures, with devastating effects on societies and economies across the world and disproportionate impacts on women.

Globally, existing data shows extreme heat claims more than half a million lives annually (experts acknowledge this is likely to be a significant undercount).[9] Hundreds of millions more people suffer from heat-related illnesses, including nausea, headaches, cardiovascular strain, infections, kidney stones, and heat stroke. Women face additional health impacts, such as pregnancy complications, pre-term birth, miscarriages, and urinary tract infections, as well as threats to their safety from heat-related gender-based violence.[10]

Heat stress becomes economic stress. The full economic costs of extreme heat – including heat-related labor productivity losses, healthcare costs, and damage to infrastructure – have yet to be fully quantified, but available evidence suggests they are substantial. In the United States alone, studies have found that heat-related labor productivity losses cost the US economy $100 billion each year.[11] Many of these costs fall most heavily on women, who shoulder the vast majority of unpaid work. When unpaid work is included, women's heat-related economic losses are 260% higher than they would otherwise be, compared to 76% for men.[12]

There is a growing body of evidence that, under the right conditions, heat interventions can reduce these impacts cost effectively.[13] However, interventions can only fulfill their potential if they are built in consultation with local communities to reflect their realities and designed to meet the needs of the most effected. Standard heat responses often fail to reach those who would benefit most: early warning systems rely on phone ownership and literacy;[14] cooling centers assume mobility and free time;[15] formal labor protections exclude informal workers by definition[16]; and healthcare surge capacity is often overwhelmed precisely when demand peaks.[17] Because women are

[9] Zhao et al. (2021)
It is widely acknowledged that this number is significantly under representative given inconsistent data collection globally.
[10] WHO (2024)
[11] Atlantic Council (2021)
[12] Atlantic Council (2021)
[13] World Bank (2025), The Case for Action: The power of prevention to support health in a changing climate
[14] Trahan, Walshe, and Mehta (2023)
[15] Duan, Zhang, and Li (2025)
[16] AREO et al. (2025)
[17] Aguilar-Gomez, Zivin, and Neidell (2025)

more economically vulnerable (they earn less income and own fewer assets than men[18]), they face higher barriers to accessing support. For example, a study of Ahmedabad's Heat Action plan found that lower literacy and phone ownership meant fewer women than men received heat early warnings, and lower incomes meant that more women continued working in dangerous conditions.[19] Interventions that are designed without the most impacted groups in mind therefore risk missing the communities they are intended to help. This is an equity imperative *and* a prerequisite for reducing overall risk.

Despite the potential for heat interventions to deliver benefits, local planners typically lack the evidence and tools needed to prioritize interventions and secure financing.[20] There remains a lack of data on how direct and knock-on effects of heat shape societal outcomes - particularly for those most impacted. For example, while heat risk is unevenly distributed within cities, one review found that only two out of 37 Indian Heat Action Plans conducted and presented vulnerability assessments, and less than half identified informal settlement residents as being vulnerable to heat.[21] Local planners and global partners often lack simple frameworks for understanding channels of impact and articulating the business case for interventions, both of which are essential for mobilizing adaptation funding. This helps explain the systematic underinvestment in heat adaptation – for example, a World Bank review of their own projects from 2012-2023 found that none of them were "heat-focused."[22]

This report addresses the gaps in the economic understanding of heat impacts and solutions. It is part of a broader initiative to build a stronger case for action on extreme heat by integrating quantitative modeling with first-hand accounts of women whose lives are significantly disrupted by rising temperatures. The analysis focuses on informal and vulnerable women workers across four cities – Ahmedabad, Bangkok, Freetown, and Monterrey – where extreme heat is already reshaping lives and livelihoods. These cities capture distinct but interconnected, multifactor heat risk profiles: humid and dry climates; episodic and year-round heat; and cities with long-standing heat policies and those just beginning to respond. They also reflect different contexts where women's vulnerability is driven by various combinations of informal work, housing quality, health status, and care responsibilities.

This Summary Report synthesizes the crosscutting trends, economic mechanisms, and policy implications across these contexts. It provides the most comprehensive analysis to date[23] on the impacts of extreme heat on women by integrating city-level climate projections, health and labor productivity modeling, gender-disaggregated economic analysis (including unpaid labor), and qualitative evidence from informal women workers. The report is complemented by a series of city-specific case studies, which illustrate how these trends manifest in lived experiences, and provide city-level statistics drawn from the analysis. Read together, this Summary Report and the accompanying case studies show how these factors overlap and compound, and how solutions can be cost effectively deployed to reach those most impacted.

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[18] UN Women
[19] Trahan, Walshe, and Mehta (2023)
[20] The Case for Action: The power of prevention to support health in a changing climate
[21] Centre for Policy Research (2023)
[22] World Bank (2024)
[23] Prior analyses have examined related dimensions of this question. Arsht-Rock (2021) quantified heat's economic costs in the United States without gender disaggregation. The Scorching Divide (Arsht-Rock, 2023) introduced gender-disaggregated analysis of paid and unpaid labor losses across India, Nigeria, and the United States, and identified the disproportionate impact on informal workers as an area requiring further research. The Lancet Countdown (released annually) tracks global heat-related labor and mortality trends annually but does not disaggregate by gender or sector.

This report is also accompanied by a City Heat Solutions Calculator tool to help policymakers identify, prioritize, and finance heat adaptation investments. The tool provides a consistent framework for comparing the costs and benefits of interventions, understanding who benefits and why, and designing portfolios that maximize social and economic returns.

The report is organized as follows:

- Section 1: Describes the direct and indirect impacts of extreme heat, highlighting how these can reinforce and perpetuate cycles of ill health and poverty.
- Section 2: Explores how women – particularly women in the informal sector – are especially vulnerable to the health and economic impacts of extreme heat.
- Section 3: Demonstrates how a portfolio of interventions can significantly reduce heat-related impacts and explains how policymakers can use the accompanying cost-benefit analysis tool to build a compelling business case for adaptation action.

Section 1: Extreme heat triggers cascading, often lasting, impacts on lives and livelihoods

Extreme heat is a systemic threat with society-wide implications

Dangerously high temperatures overwhelm health systems, suppress productivity, raise prices for essential goods, and push vulnerable households into debt, creating lasting health, economic, and social scars. These effects reinforce each other, meaning that the consequences of a single heatwave can persist for years.[24]

Health impacts are central to the story. Extreme heat is a major driver of death and disease, with consequences that extend far beyond the duration of a single event. In Bangkok, a third of the city's residents report heat stress symptoms during heatwaves.[25] In Ahmedabad, more than 16,000 people experience serious cardiovascular, respiratory, or renal complications due to extreme heat each year. Some of the most serious harm presents long after the heat has passed. For example, heatwaves are associated with a 25% rise in adverse pregnancy outcomes like pre-term births, which can affect long-term cognitive and sensory outcomes for children.[26]

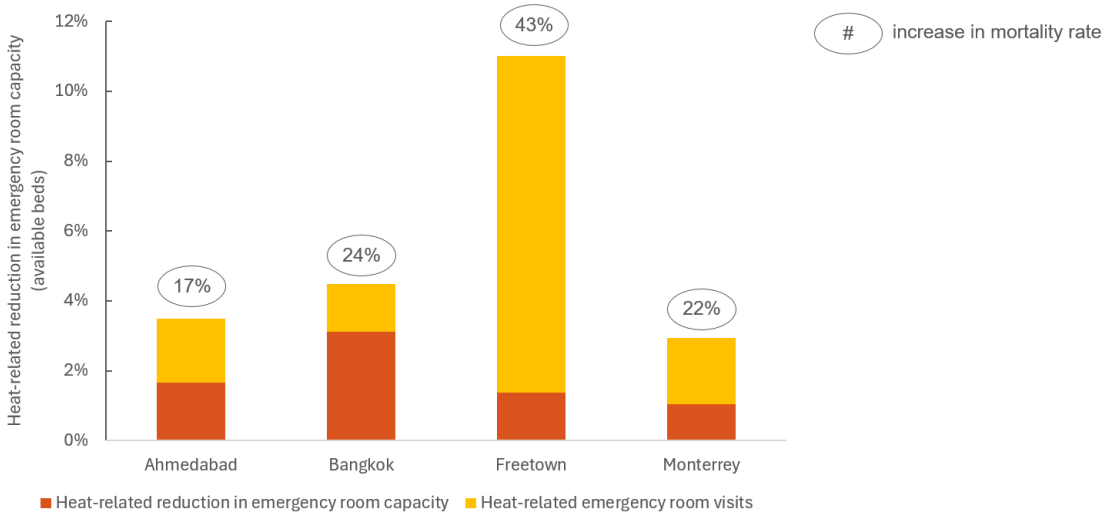
Effects of extreme heat do not end when the sun goes down. Nighttime temperatures, which in many cities are rising even more rapidly than daytime highs, are increasingly recognized as a critical contributor to illness and death.[27] Hot nights are damaging on their own, compromising mental health and immune functions, worsening underlying conditions, reducing sleep quality, and materially raising the risk of accidents during the day.[28,29,30,31] But hot nights in conjunction with hot days (known as compound heatwaves) are the most detrimental, as they allow the body no respite from heat. Together, hot nights and compound events account for 85% of heat-related mortality. These elevated nighttime temperatures have the most severe impacts on lower-income residents, who are more likely to live in homes that lack cooling or are built outside of established planning and building regulations. These homes often intensify heat, as common building materials like corrugated iron and tin sheets trap heat indoors overnight. This prevents residents from cooling down, increasing the health risks from heat.

As extreme heat drives illnesses and accidents, it simultaneously reduces the capacity of health systems to respond. In Monterrey, emergency departments see 2,000 excess visits a year during heatwave days, the equivalent of nearly a month of admissions to a single emergency department (in extreme years, excess visits are 5,000).[32,33] At the same time, extreme heat limits hospital capacity by reducing healthcare workers' physical and cognitive performance – and their ability to carry out their functions, as illustrated in Figure 1. These compounding effects result in overcrowding, longer waiting times, and patients being turned away. This analysis finds that heat-related hospital crowding increases mortality from extreme heat

[24] Costa and Hooley (2025)
[25] Tawatsupa et al. (2012)
[26] Lakhoo et al. (2024)
[27] Climate Resilience for All (2025)
[28] Obradovich et al. (2017)
[29] Basu (2009)
[30] Bigler & Janzen (2024)
[31] Drescher & Janzen (2025)
[32] Hernandez-Guedea et al., 2025
[33] These figures represent *statistically estimated* excess emergency department visits attributable to extreme heat, not clinically coded heat-related illness.

by about 17% in Ahmedabad, up to 43% in Freetown, reflecting how mortality increases rapidly in settings where healthcare capacity is low.[34]

Figure 1 – Heat-related strain on healthcare capacity (2025)[35]



The health toll of heat quickly translates into economic loss, with severe impacts on worker productivity and economic growth. Extreme heat increases heart rate and causes sweating, dehydration, and fatigue, which, in turn, reduces workers' physical and cognitive performance, making regular tasks take longer.36 It decreases workforce productivity by 8% annually in Freetown (13% in extreme years) – the equivalent of removing 38,000 jobs in a city of 1.3 million. Lower worker productivity means lower output, which has knock-on impacts for the citywide economy. In Bangkok, heat drives losses equivalent to 4% of the city's GDP (8% in severe years), more than the city's annual budget.[37] Lower economic output leads to reduced tax receipts and reduced public funding available for health, infrastructure, and development spending.

Essential goods and services become less accessible and more expensive during heatwaves. Up to 5% of Freetown's food supply spoils during heatwaves, leading to annual price increases of up to 2% increase for foodstuffs – equivalent to a month's worth of utility payments for an average family.[38] Price rises for essential goods and services disproportionately affect poorer communities and households, who spend a greater proportion of their income on basic needs. For the most vulnerable, higher food and energy costs reduce access to food and contribute to higher rates of malnutrition – one study found that across lower- and middle-income countries, a 5% increase in real food prices increased the risk of severe wasting in pre-school children by 14%.[39]

The impacts of heat are persistent and expected to rise

These economic impacts and spillovers cause long-term economic scars. Loss of spending power due to lower wages and higher prices can compel households to borrow money or sell productive assets to cover

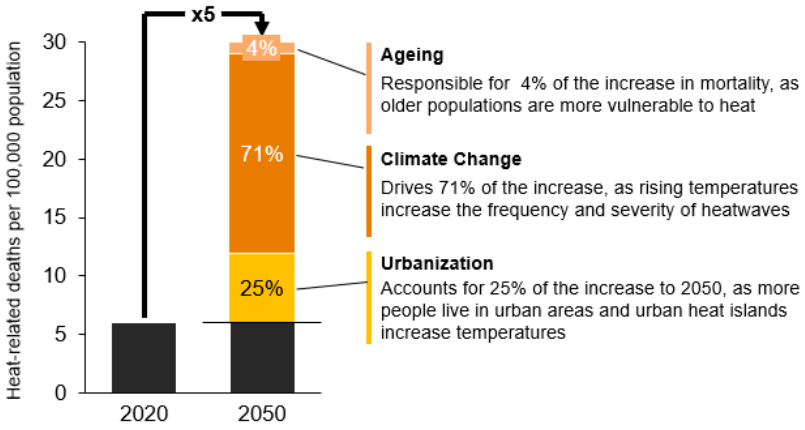
[34] Extreme heat, hospital crowding, and the hidden health costs of climate change | CEPR
[35] Reduction in emergency room capacity is assumed to be in proportion to the reduction in healthcare worker productivity. The impact this has on care is computed using emergency room beds as a proxy variable for capacity. See the Technical Appendix for full details.
[36] ILO (2019)
[37] Bangkok Post (2024)
[38] Own calculations.
[39] Headley and Ruel (2023)

short-term expenses. The poorest families often lack access to formal credit, forcing them to take out predatory loans at high interest rates, sell assets or household items, or simply consume less, meaning that the negative economic impacts of a single event can endure for years.[40] Our modelling suggests that heat-related wage losses increase household indebtedness by 3% per year in Freetown. One IMF analysis suggests that a 3% increase in household indebtedness can reduce GDP by 0.75% (in the US, hurricanes often inflict damage equal to 0.5-1% of GDP41). [42]

These impacts on lives and livelihoods from extreme heat are mutually reinforcing, creating self-perpetuating cycles of harm. Heat-related illnesses cause people to miss work, while continued exposure at work increases the risk of injury or sickness. Evidence from Switzerland suggests that workplace accidents rise by 5% during heatwaves.[43] Informal workers often lack injury pay, so injury results in them incurring additional costs from seeking treatment while simultaneously losing income from being out of work. This reinforcing loop can trap workers in cycles of falling incomes and worsening health.

These impacts are increasing as climate change, urbanization[44], and ageing populations[45] drive the prevalence, intensity, and impacts of extreme heat higher in cities. Figure 2 shows how each of these drivers contributes to increasing heat-related deaths in Freetown. By 2050, heat-related deaths are expected to increase fourfold in Ahmedabad, and nearly fivefold in Freetown, Bangkok, and Monterrey. In Freetown, extreme heat will claim the lives of 30 in 100,000 people each year by 2050 – greater than deaths from cervical cancer, road injuries, malnutrition, or HIV/AIDS.[46] 80% of these projected heatwave deaths in Freetown are attributable to climate change, which increases the severity and number of heatwave days.

Figure 2 - Projected increase in heatwave deaths by driver (Freetown, 2020-2050)



[40] Sullivan (2005)
[41] Ritchie et al. (2022, revised 2026)
[42] IMF (2017). Here we have assumed a linear relationship between indebtedness and GDP reduction, from IMF figure of 5% indebtedness causing 1.25% percentage point reduction in GDP.
[43] Drescher et al. (2025)
[44] The urban heat island (UHI) effect is a phenomenon where urban areas experience significantly higher air and surface temperatures than surrounding rural areas, due to heat trapping, reduced ventilation, heat-absorbing surfaces (like roads and buildings), and anthropogenic heat (from heating or cooling technologies). Ojeh et al. (2016) found the UHI effect in Lagos to be up to 7°C at night.
[45] Older adults (65+) are disproportionately vulnerable to extreme heat due to diminished physiological, cognitive, and social factors
[46] Study calculations compared to estimates from WHO (2021) – figure refers to heatwave deaths exceeding deaths from those diseases individually, not combined

These findings demonstrate that extreme heat operates through interconnected health, economic, and social pathways. By overwhelming health systems, suppressing productivity, and increasing household vulnerability, heat generates long-term economic scarring that threatens urban development and resilience. These burdens are born unevenly, with women, especially those in informal employment, experiencing the greatest exposure and least protection.

Section 2: The impacts of extreme heat fall most heavily on women, especially those working in the informal sector.

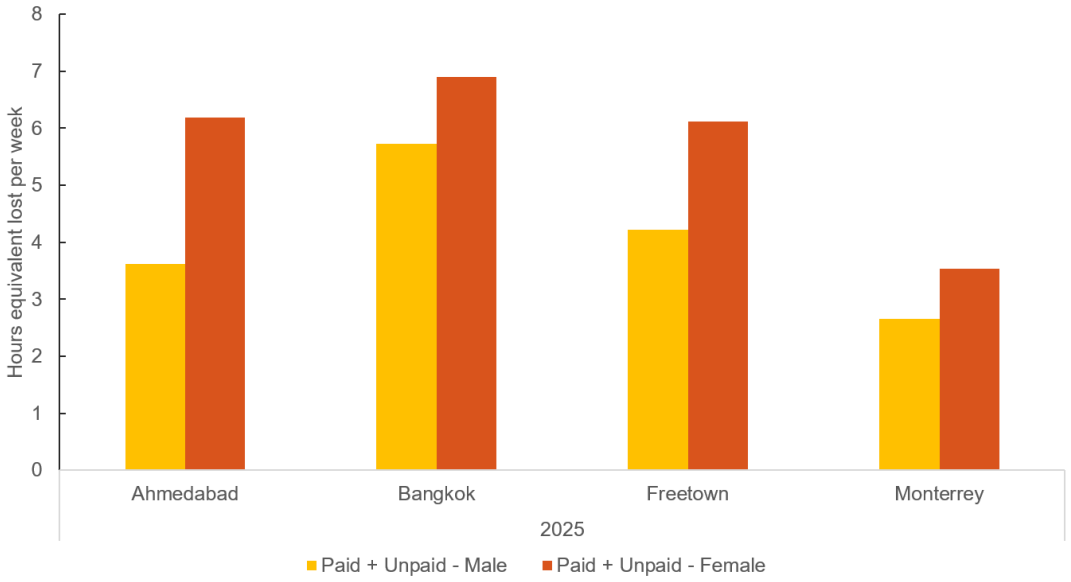
Women are dramatically and disproportionately affected by extreme heat

In the assessed cities, women bear a disproportionate heat mortality burden. Heat accounts for a larger share of women's mortality than men's – by 16-20% – due to a combination of physiological factors and the social and economic conditions that increase women's exposure and reduce their resilience. On average, women maintain a higher baseline body temperature than men[47] and, under heat stress, can reach dangerous internal temperatures faster due to differences in body composition, hormonal fluctuations, hydration needs, sweat rate, and blood flow.[48] Pregnancy, menstruation, and other hormonal changes further heighten women's susceptibility to heat.[49] Obstetric complications, including miscarriage, pre-term births, maternal morbidity and mortality, and stillbirth, rise during heatwaves and are becoming more common as heatwaves become more severe and frequent.[50] In Monterrey alone, heat-related pre-term births are expected to more than triple over the next 25 years.

These health risks are further intensified by deeply gendered economic and caregiving responsibilities, which increase women's exposure to extreme heat while simultaneously reducing their financial resilience. Women's economic vulnerability (Figure 4) is largely driven by the significant amount of time they spend on unpaid labor. Women perform at least twice as many unpaid hours as men in critical roles such as caregiving and other domestic work – tasks for which they are not compensated but are still exposed to heat-related productivity losses. In Ahmedabad, for example, women report spending 120 additional minutes of unpaid domestic work on heatwave days[51], due to both ordinary domestic tasks taking longer and additional caregiving for family members who fall ill with heat-related illness. Unlike lost paid hours, lost unpaid hours carry no insurance, no sick leave, and no piece-rate equivalent – the burden falls entirely on women and their households. This surge in unpaid labor also crowds out time for paid employment, reinforcing women's exclusion from income-generating opportunities.

[47] Shmerling (2023)
[48] Ibid.
[49] Yuzen et al. (2023)
[50] Lakhoo et al. (2024)
[51] Fuller Project (2022)

Figure 3 - Hours lost per week, weighted average



Impacts on paid work compound these losses further. In the cities analyzed, women suffer heat-driven annual productivity losses ranging from about 3% in Monterrey to 11% in Bangkok. Because they already earn less than men – from 66% less in Freetown to 4% less in Bangkok – even modest productivity losses translate into a greater proportional hit to household income, leaving fewer resources to fall back on. The implications also vary by work setting: informal and hourly workers see wages fall directly with productivity, while salaried workers may work longer hours to compensate – hours that, for women, come on top of already heavier unpaid labor.

Beyond lost income and opportunity, extreme heat also undermines women's safety and wellbeing through deeply gendered social dynamics that increase exposure to violence. Extreme heat is associated with elevated rates of gender-based violence, as it increases both aggression and time spent at home.[52] Each additional heatwave day during the average year increases the annual rate of domestic violence by nearly 1%.[53] By 2050, Monterrey is expected to see 20 additional heatwave days annually, resulting in a 17% increase in domestic violence rates. The threat of violence extends beyond the home too: fear of harassment or assault limits when and where women can safely work, travel, or seek cooling,[54] constraining their ability to take on paid work, access markets, or pursue economic opportunities in ways that add to the income losses heat already causes.

These economic and safety risks are further compounded by social and cultural constraints, which pose additional barriers to women's ability to adapt to extreme heat. Low-cost protective measures – such as wearing light clothing, going outside at night, and drinking plenty of water – can reduce or ameliorate heat stress. Yet women face unique barriers in using these strategies. In some contexts, social norms or dress requirements limit the ability to wear lighter or more breathable clothing; restrictions on women's mobility may make it unsafe or socially unacceptable to be outdoors at night; and insufficient access to safe, hygienic

[52] Stevens et al. (2023)
[53] Le (2025)
[54] Ceccato and Loukaitou-Sideris (2021)

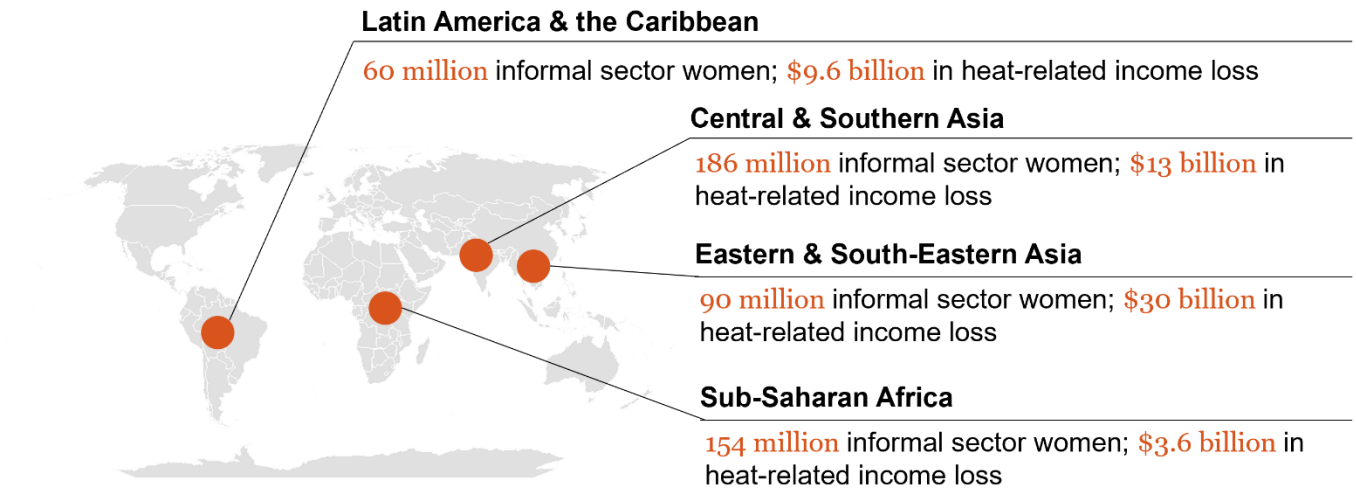
sanitation facilities can discourage women from drinking enough water, increasing the risk of dehydration. Altogether, these factors make women significantly more vulnerable to the effects of heat than men.

Women working in the informal sector are most at risk from heat

A key factor driving women's vulnerability to heat is the concentration of employed women in the informal sector. Across the cities in this analysis, working women are consistently more likely than working men to be employed informally, reaching as high as 91% of employed women in Freetown (compared to 83% of employed men).[55] Informal work operates outside of regulatory frameworks and legal protections, meaning workers usually lack formal contracts, fixed hours and wages, and union representation. As a result, those in the informal economy are disproportionately exposed to unsafe working conditions, exploitation, and abuse.[56] Concentrated in low-paid occupations such as domestic work, home-based work, street vending, market trade, and waste picking, women in the informal workforce are often required to work long hours outdoors or in poorly ventilated spaces.[57]

Nor do these women find respite outside of work. Informal sector workers are more likely to live on the margins, where housing and basic services are precarious.[58] Low and unstable incomes push many into informal dwellings, often constructed with corrugated iron or tin sheets that have poor insulation and tend to trap heat.[59] Beyond the home, these women are more likely to travel on foot or an uncovered bus, extending their exposure to extreme heat throughout the day.[60]

Figure 4 - Female informal sector population and heat-related income loss



Globally, informal sector women lose an estimated $57 billion in earnings per year due to productivity losses from extreme heat. Figure 4 illustrates that losses are greatest in Eastern & South-Eastern Asia ($30 billion a year), where high heat and humidity drive heat-related lost wages up to 11%. The largest number

[55] ILOSTAT
[56] Roever and Rogan (2016)
[57] WIEGO (2025)
[58] UNICEF MICS – add citation
[59] UN-Habitat (2025)
[60] Storeygard (2025)

of informal sector women are in Central and Southern Asia (186 million), where extreme heat erodes an average of 7% of their earnings each year. While the total earnings loss is relatively modest, this is due to low existing wages rather than low impacts.

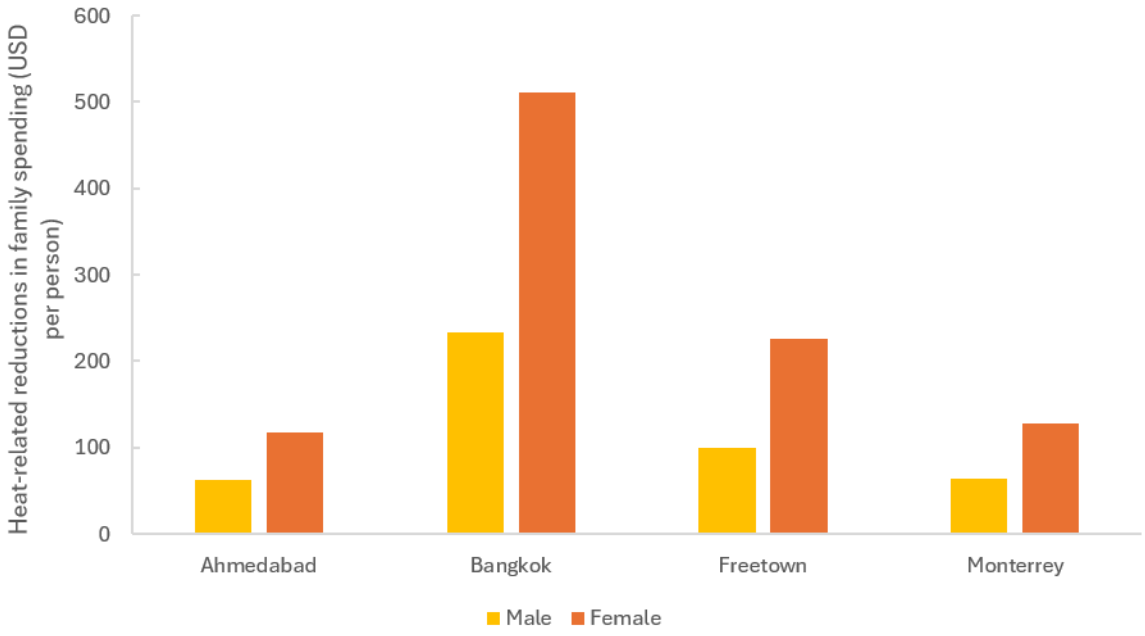
Figure 5 – Heat-related earnings losses for informal sector women

Region	Heat-related earnings loss	
Central & Southern Asia	7%	(equivalent to about half of expenditure on fuel and light for poor households)
Eastern & South-Eastern Asia	11%	(equivalent to the cost of housing for the very poorest)
Sub-Saharan Africa	8%	(approximately equivalent to expenditure on produce)
Latin America & the Caribbean	4%	(equivalent to low-income households' expenditure on education – tuition, books)

The financial impacts of income lost to extreme heat ripple outward from the women workers, slowing citywide economic development. Women invest up to 90% of their income in their families and communities – compared to 30-40% invested by men[61] – leading to better health, education, and well-being outcomes if that investment can be maintained.[62] Increases in women's incomes are associated with reduced rates of domestic violence[63], improved health, nutrition, and school attendance[64], and higher rates of loan repayment[65] compared to men. Figure 5 shows that extreme heat reduces the amount a woman invests annually in her family proportionally to her productivity loss: by up to 11% ($500) in Bangkok, 8% ($200) in Freetown, and 7% and 4% ($100) in Ahmedabad and Monterrey (respectively). Such reductions can come in tuition payments, textbooks, uniforms, medical care, or nutrition, all of which can have long-term impacts on children's development and prospects. Reduced investment in human capital stalls economic development – less investment in children's schooling and health today leads to a less productive workforce in the future.

[61] While it is well-documented that women re-invest in their families at higher rates than men, there is dissensus around the exact rates, with various sources reporting that women re-invest 60% to 90% of their earnings.
[62] IMF (2024)
[63] Machado et al. (2024)
[64] Sugiyama and Hunter (2020)
[65] Heath and Riley (2024)

Figure 6 - Heat-related reductions in annual family investment[66]



The concentration of heat's impacts among women in informal work is a roadmap for action. Because the channels of harm are identifiable – exposed working conditions, unpaid care burdens, precarious housing, and gaps in protection – they can be targeted. Section 3 shows that a portfolio of low-cost interventions, designed with these realities in mind, can break the cycle of ill health and lost income, and demonstrates how policymakers can build the business case for investing in them

[66] Reductions in family investments are calculated by first calculating heat-related productivity losses (using daily temperature and humidity data, alongside workability functions), extrapolating wage losses, and then applying gender-specific multipliers cited in [44]. Results are indicative and full details of the methodology can be found in the accompanying Technical Appendix.

Box 1 – Informal sector women and heat-related impacts in Los Angeles, California

Extreme heat has wide-reaching and severe consequences – and wealthier cities are not immune. Despite higher incomes and greater access to adaptive measures like air conditioning, cities like Los Angeles suffer heat-related health impacts of a similar magnitude to those experienced by the other cities in this analysis. In Los Angeles today, extreme heat is responsible for 5.2 deaths per 100,000 population (nearly 1.5% of all-cause mortality). This analysis suggests that this would rise to nearly 20 deaths per 100,000 by 2050.

Affluent cities are also more economically vulnerable to the effects of extreme heat than high-level macroeconomic statistics suggest. For example, while rates of informal sector employment are not consistently monitored or reported in the United States, U.S. Census analysis finds that nearly 14% of privately employed workers in Los Angeles County are employed informally.[1,2] Women in the informal sector are more likely to work in heat-exposed conditions, particularly as street vendors.[3] Exact statistics are not available, but many of these women are also migrants, meaning they are often excluded from labor protections and cannot regularly access public services. Consequently, informal sector women in Los Angeles can lose up to three times as much of their earnings to extreme heat compared with women working in the formal sector – with their losses set to triple by 2050.

[1] Graham & Ong (2007)

[2] This is likely an underestimate for two reasons – the data are self-reported and this study was carried out before the rise of the 'gig' economy.

[3] PBS

Section 3: Low-cost interventions can reduce overall impacts, while relieving the suffering of the most vulnerable

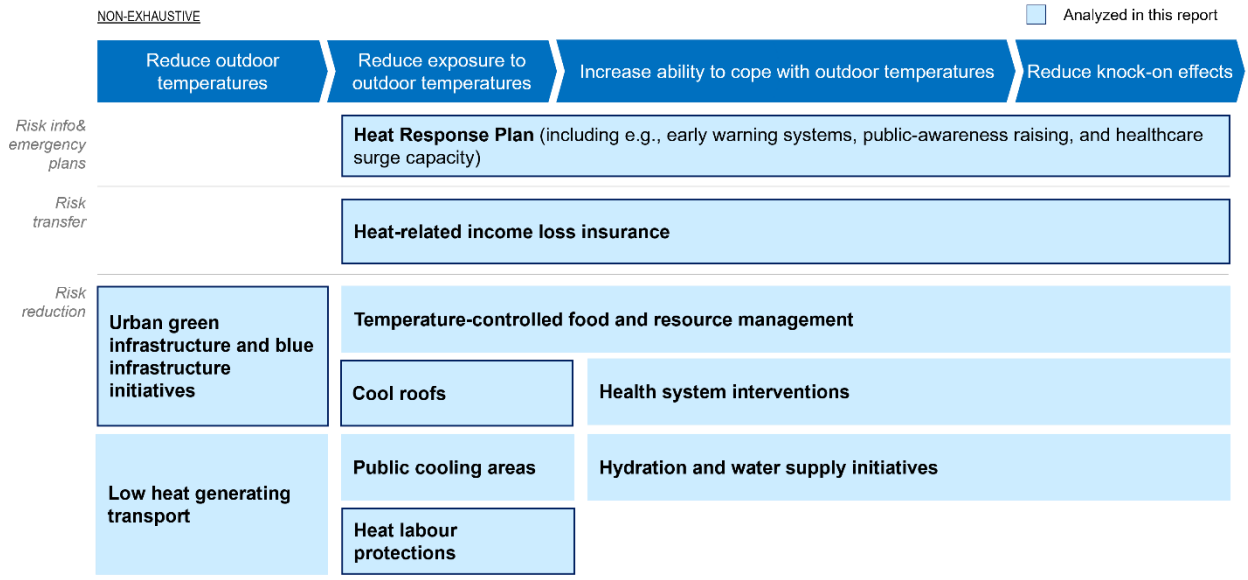
Extreme heat exacts a heavy toll, but relatively low-cost interventions can materially reduce heat-related illness, injury and economic loss.[67] Cities and countries around the world are already experimenting with innovative measures to protect their residents from extreme heat. For instance, Ahmedabad enacted one of the world's first Heat Action Plans following a major heatwave. The response plan includes public awareness-raising, an early warning system, and inter-agency coordination and training. An evaluation of the policy found that it prevented 2,380 deaths between 2014 and 2015.[68] In informal settlements in India and Sierra Leone, where metal roofs trap heat indoors, cool roof programs are being piloted, which have already been found to reduce indoor temperatures by 2 to 7°C (3.6 to 12.6°F).[69] Thailand has introduced occupational heat standards that require employers to take protective measures (e.g., pause outdoor work or provide protective equipment) when temperatures reach dangerous levels. These standards have been found to protect 80% of workers from heat-related illnesses in compliant workplaces.[70] California has introduced labor protections requiring shaded rest areas, water, and breaks, which have reduced mortality in outdoor workers by 43%.[71] In India, HERA and the Self-Employed Women's Association (SEWA) launched a multi-year insurance program that compensates informal sector workers for income lost during extreme heat, allowing women to make decisions about adjusting their work and stay cool without foregoing earnings. The program provided automated cash assistance when temperature thresholds (e.g., 40°C or 104°F) are crossed to more than 300,000 informal sector women.[72] Expanding and targeting similar interventions can alleviate heat-related suffering among the most vulnerable.

This report analyzes a set of interventions that can help reduce and manage heat risks and impacts (Figure 7). There are many ways to do this – cooling the city itself, reducing how much heat people are exposed to, helping people cope when heat strikes, or softening the financial blow when heat cuts into incomes. Rather than attempting to cover every option, we have modelled a set of interventions selected to be

[67] Das et al. (2025)
[68] Hess et al. (2018)
[69] Vellingrini et al. (2020), MEER, Baiman et al. (2024)
[70] Phanprasit et al. (2021)
[71] Dean and McCallum (2025)
[72] CGAP (2026)

representative across these dimensions: they work through different pathways, span social programs as well as physical infrastructure, and include both city-wide measures and those targeted at the most vulnerable. A city-wide urban greening program, for example, lowers temperatures for all residents, while an insurance program can be aimed at groups whose livelihoods depend on working in the heat. Targeting smaller, higher-risk groups means each dollar spent can save more lives and protect more income than a city-wide intervention of the same cost. All interventions modelled here have been piloted somewhere in the world, with the analysis building on real evidence.

Figure 7 – Intervention framework



This analysis finds that these interventions – implemented either as a portfolio or individually – materially reduce heat-related impacts at relatively low cost. Taken together, a package of these interventions in Monterrey, Mexico, could reduce mortality by 36% by 2050 and provide $171 million annually in health and economic benefits – at an annual cost of $106 million.[73]
The interventions work in complementary ways, operating over different timescales and

protecting different groups. Heat Response Plans[74] provide the foundation: by warning residents of dangerous heat, raising awareness of protective actions, and ensuring emergency healthcare capacity, they could reduce city-wide heat-related mortality by nearly 13%.[75] They are also among the cheapest measures available – providing nearly $37 million in benefits while costing Monterrey $2.9 million annually, mostly in establishing coordination mechanisms and early warning systems,[76] which is why they are typically the first intervention cities adopt.

Physical cooling measures complement these emergency responses by reducing the underlying heat hazard itself, though their benefits arrive on different timescales. Cool roofs offer immediate relief: low-cost reflective materials reduce indoor temperatures from the day they are installed, providing nearly $14 million in benefits (including through cutting heat-related mortality by up to 5% by 2050) at an estimated

[73] These figures are for Monterrey, Mexico – they are representative of dynamics across the representative cities.
[74] A Heat Action Plan – for the purpose of this analysis – consists of an early warning system, community awareness-raising, and healthcare surge capacity. The efficacy of heat action plans is based on the experience of Ahmedabad, India.
[75] https://onlinelibrary.wiley.com/doi/10.1155/2018/7973519
[76] https://climatesmarthealth.org/articles/heat-early-warning-systems.pdf

cost of $5.6 million annually. The benefits accrue disproportionately to low-income households living in poorly insulated buildings without access to air conditioning – precisely those facing the greatest indoor heat risk. Benefits from urban green space materialize more slowly. Increasing green cover by 5% could reduce heat-related mortality by 15% in 2050 by lowering city-wide temperatures, delivering $85 million in benefits at an annual cost of $77 million, concentrated in the early years of planting. But trees must mature before they offer their full shading protection, so cities that plant today are protecting residents a decade from now. This makes green space a poor emergency response but a strong long-term investment.

A final set of interventions protect people where the heat meets their livelihoods. Labor protections (including shaded rest areas, potable water, and mandatory breaks) could produce nearly $6 million in benefits (mostly in protecting the exposed workforce) at a relatively low annual public cost of $2.3 million (though this does not fully account for compliance costs to businesses). The effect on productivity is more nuanced: mandatory breaks have offsetting effects within the working day, reducing time spent working but raising productivity during the hours worked; however, lower rates of worker illness and injury should increase overall output. Their reach, however, is largely limited to the formal sector, where regulations can be enforced. For the informal workers who fall outside these protections – disproportionately women – heat-related income loss insurance fills part of the gap, providing payouts on heatwave days that could reduce informal sector women's earnings losses 12% in 2050. Neither measure cools residents; both determine whether a hot day becomes a health or financial emergency.

This combination – material reductions in mortality and income loss, achieved at modest cost – is the core of the investment case for heat solutions. Every intervention analyzed delivers a positive benefit-cost ratio (BCR): each dollar invested yields multiple dollars in health and economic benefits, reflecting avoided productivity losses, reduced mortality, and improved well-being, particularly for vulnerable populations. Table 1 summarizes the BCRs across all cities analyzed. Heat Response Plans generate returns between 12 and 90 times their cost, while cool roofs and labor protections deliver strong returns across contexts. Even interventions with more modest ratios, such as heat-related income loss insurance, generate benefits that outweigh their costs while providing social protection and risk-sharing that is strongly targeted toward vulnerable groups.

Realizing these returns in full depends on evidence-based design co-created with impacted communities. Early warning systems, for example, can rely on phone ownership and literacy, limiting their reach among the populations most at risk. [77] But carefully designed action can close these gaps: Surat's gender-integrated Heat Wave Action Plan combined vulnerability mapping of informal settlements, gender-specific guidance on heat illness, and targeted measures for pregnant women and those in informal housing.

[77] Trahan, Walshe, and Mehta (2023)

Table 1: Benefit-cost ratios across representative cities[78]

	Ahmedabad	Bangkok	Freetown79	Monterrey
Heat Response Plan	18.0	16.6	93.2	12.6
Cool roofs	3.3	4.5	65.7	2.5
Green space	2.5	1.2	3.5	1.1
Labor protections	6.8	5.0	181.380	2.4
Heat-related income loss insurance	1.6	1.6	2.4	1.7
Portfolio	2.9	4.9	5.0	3.0

The severe and unequal impacts of extreme heat are not inevitable. Although there are costs associated with heat adaptation and benefits can take several years to fully materialize, this analysis shows that well-targeted, cost-effective interventions can substantially reduce mortality and income losses while delivering strong economic returns. This demonstrates that heat adaptation is not only a social imperative, but a sound investment in long-term development.

[78] The BCR for green space assumes that cities add green space worth 5% of the city area. The BCR for cool roofs assumes that cities implement cool roofs on 15% oThe BCR for heat-related income loss insurance assumes 120,000 people are enrolled in the scheme.
[79] Freetown lacks consistent climate data, meaning higher uncertainty in the results than the other cities.
[80] Labor protection costs in Freetown are close to $0 in our analysis, leading to a high BCR. As this estimate does not fully account for employer costs, this is likely to be an underestimate of this intervention's benefits relative to its costs.

Our City Heat Solutions Calculator Tool provides cities with a clear starting point for turning climate and heat risk assessments into practical adaptation strategies. While this report shows that adaptation interventions can have very strong business cases, it also highlights the complexity in the relationship between heat and health and economic outcomes, which can make business cases difficult to construct. The objective of the tool is to provide users with accessible metrics on the value for money associated with such adaptation interventions.

The tool enables practitioners and policymakers to compare the indicative economic returns of different interventions, highlighting which actions are likely to deliver the greatest overall value. It estimates the effects of a few widely applicable interventions in reducing key heat impacts (mortality and productivity loss) and highlights how costs and benefits break down. The structure allows users to compare priorities, trade-offs, and potential funding approaches.

The tool offers a global analytical framework to guide (but not replace) local feasibility and impact studies. Investment decisions must ultimately rely on detailed and context-specific assessments. What the tool does is help cities articulate the rationale for adaptation, communicate and quantify the scale of potential benefits, and engage with national governments, development partners, and financiers. By providing a transparent and replicable framework, it fosters a shared understanding of the economic case for action and investment.

Conclusion

Extreme heat is already exacting a heavy toll on health and economic development – and that toll is set to grow. The four cities analyzed lose more than 1,000 lives and up to 4% of city GDP to heat in an average year. Globally, extreme heat costs women working in the informal sector over $57 billion in earnings annually. Without action, these impacts will intensify three- to five-fold by 2050. This is not a distant climate risk: it is a present-day crisis for growth, health, and equality that demands a policy response.

Yet the evidence also points to a tractable path forward. This analysis finds that investing in adaptation can reduce these effects at a relatively affordable cost. A portfolio of interventions could cut heat-related mortality and materially reduce income losses, with benefits that far outweigh costs.

Those returns, however, are not guaranteed. Interventions deliver their full value only when they reach the people most exposed. Standard heat responses often fail to consider the lived realities of those most impacted: they rely on phone ownership, literacy, mobility, or formal employment that the most vulnerable, particularly informal women workers, may lack. Drawing on city-level climate projections, health and productivity modelling, gender-disaggregated economic analysis, and first-hand accounts from informal and vulnerable women workers, this report provides the evidence base for inclusive design. But evidence alone will not close the gap: heat adaptation remains underfunded, fragmented, under-measured, and poorly understood. Addressing this demands action on four urgent priorities:

1. Develop sustainable financing models: Despite strong benefit-cost ratios, heat adaptation remains systematically underfunded, at least partly because the benefits of action are diffuse and, to a significant extent, non-monetary in nature. Closing this gap will require mobilizing a wider range of instruments, including insurance mechanisms that provide income protection for the most vulnerable workers, greater engagement of private sector actors who bear direct exposure to heat-related productivity and supply chain losses, with catalytic philanthropic investment to pilot financing models and build evidence of returns. These models will, in many cases, blend multiple forms of private capital with public and concessional sources.

2. Build deeper partnerships across sectors and levels of government: No single institution can address the full range of heat risks: health systems, city governments, employers, community organizations, and national policymakers each control different levers. This analysis shows that interventions work best in combination (e.g., an early warning system is more effective when paired with labor protections that compel employers to act on warnings). Moving from isolated pilots to systemic adaptation at scale requires coherent, mutually reinforcing responses across sectors and between city and national governments.

3. Invest in better evidence on women-centered heat impacts: While this analysis is the most comprehensive to date, it is built on data that remain patchy and inconsistently collected. Heat mortality statistics are rarely disaggregated by gender; the unpaid labor burden of heat is almost entirely unmeasured in official statistics; and the evidence base on which interventions most effectively reduce heat risk for women in the informal sector is thin. Closing these gaps requires investment in gender-disaggregated data collection through national statistical systems, and in impact evaluations that track outcomes for women. Without better evidence, the risk is that adaptation resources are allocated in ways that leave the most exposed populations behind.

4. Build heat literacy for informed action: Evidence on the dangers of extreme heat exists – but it is not reaching the people who need it most. Many of those facing the greatest risk, including informal women workers, lack access to clear, actionable information about how heat harms health and what protective

steps they can take, while heat illness frequently goes unrecognized until it becomes severe. The gap extends to decision-makers: extreme heat remains under-prioritized in policy agendas relative to the scale of its impacts, in part because the impacts are not well understood. Building heat literacy at both ends – through community-level awareness campaigns, and through sustained engagement with policymakers– is a precondition for every other priority in this list.

The window for building heat resilience is narrowing. Heatwaves are already becoming more frequent, more intense, and longer-lasting – and this will accelerate in the decades ahead. The cities and communities that will be most affected are least equipped to act alone. Translating the evidence assembled in this report into sustained investment and systemic change will require continued commitment from healthcare providers, city leaders, national governments, development partners, and the private sector, working in concert and with an understanding of the scale of what is at stake. The case for action is clear. The time to invest is now.

We build resilience to extreme heat

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