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Cultural Contexts of
Health & Wellbeing
INITIATIVE

Beyond Temperature: A Cultural Contexts Approach to Heat and Health

With funding from the Robert Wood Johnson Foundation and in collaboration with WHO/ Europe's Behavioral and Cultural Insights Unit, the **Vanderbilt Cultural Contexts of Health and Wellbeing Initiative** uses cultural insights to help improve public health policy and healthcare delivery.

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Executive Summary

Extreme heat is the deadliest weather-related health hazard of the twenty-first century. Yet conventional responses remain insufficient—and sometimes counterproductive. Public health and planning approaches focus on temperature metrics, cooling technologies, and alerts, often overlooking the real-life complexity of heat. This report makes a key intervention: heat is not only a climate variable or biomedical stressor, but also a socially produced condition shaped by how people live, work, and adapt in specific cultural and environmental contexts. Health risks are bound up with cultural expectations, labor regimes, racial geographies, and historical marginalization. When these are ignored, policies miss who is most at risk—and why.

Imagine an older woman with diabetes living alone in a poorly ventilated apartment. She hesitates to use the air conditioner because of cost, has no nearby family, and relies on an overburdened clinic for healthcare and insulin. The temperature outside may be the same for everyone, but her risk is magnified by housing insecurity, social isolation, and limited healthcare. A **syndemic framework**[1]—focusing on how health and social problems interact—captures these dynamics: heat impacts arise not from temperature alone, but from the convergence of biological vulnerability, social arrangements, and political conditions, all mediated by cultural contexts.

Across the world, unequal infrastructures create zones of thermal privilege and harm. Sweat, shade, clothing, architecture, food, and work schedules all offer culturally rooted strategies for managing heat—yet these are often excluded from policy. Reliance on technologies such as air conditioning, while lifesaving in emergencies, reinforces social divides, contributes to environmental harm, and limits long-term adaptability. The syndemic approach shifts the focus from individual risk to systems of vulnerability, offering a more holistic and just framework for public health and climate adaptation.

This report identifies three pathways for policy:

LOOK LOCAL

Heat vulnerability is uneven and socially produced. Grounding responses in community practices—such as shaded infrastructure (canopies, trees and green roofs), adaptive housing, or collective rhythms of rest—makes them more equitable and effective.

LOOK AROUND

Knowledge about heat remains fragmented across disciplines and institutions. Bridging these divides can reveal heat's syndemic nature and enable systemic solutions.

LOOK UP

Cultural biases shape our assumptions of comfort and risk. Reimagining thermal cultures can inspire more sustainable and just futures.

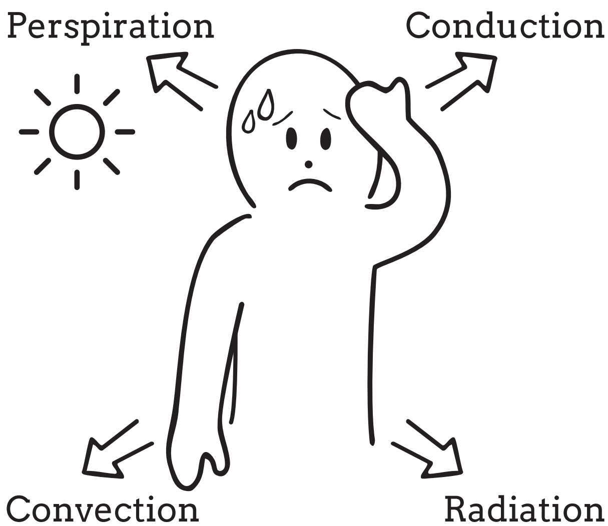
By centering cultural insights, this report provides a roadmap for more equitable and effective policy responses. Cultural knowledge is not an afterthought; it is infrastructure. It shapes behavior, trust, and risk perception. To address rising temperatures, policymakers must design strategies that are not only scientifically sound but also socially relevant and culturally grounded.

Overview

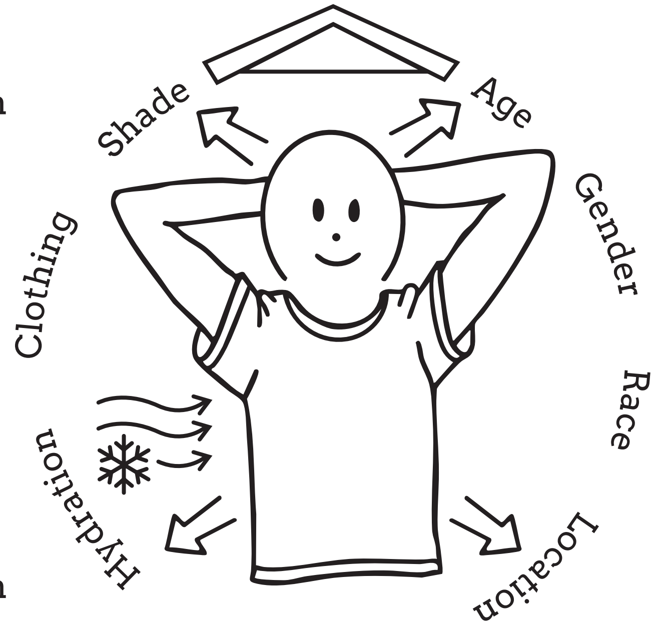
Extreme heat is an increasingly deadly public health threat, yet its impacts remain surprisingly difficult to track. Unlike tornadoes or blizzards, heat is largely invisible, and its long-term health impacts are often overlooked. Over recent years, given increasing temperatures in many places, heat has emerged as a major public health threat, but public health surveillance has not kept pace. While we have some data on deaths directly caused by heat, we lack information on cases where heat was a contributing factor. Estimates suggest that excess mortality from heat exceeds 10,000 deaths annually in the U.S. and approaches 500,000 worldwide.

All heat-related deaths are preventable, argues climate scientist Kristie Ebi.[2] This view challenges prevailing models that tend to portray humans as passive recipients of heat emanating from sources like the sun. In those models, "heat" is often understood as synonymous with temperature and reduced to a numerical thermometer reading.But temperature and heat are not the same. Temperature (the average kinetic energy of a mass such as mercury in a thermometer) is a number on a scale. Heat is the transfer of energy that people actually feel. Building on that distinction, we understand the transfer of energy, or heat, to be a culturally mediated experience shaped by clothing and architecture as well as social norms and public policy. In this sense, **the health impacts of heat are socially produced:** we create environments and conditions that make some of us more vulnerable to heat.

By early afternoon in California's Central Valley, it is 100°F (37.7°C). The sun beats down on rows of strawberries where Miguel, a 38-year-old migrant worker, bends low to pick fruit. His denim shirt and jeans shield him from pesticides and sunburn, but the heavy fabric holds the heat against his skin. Supervisors urge the crew to keep pace, so water breaks are brief and shade is distant. Across the globe in Telangana, India, Lakshmi, a 42-year-old agricultural laborer, also faces 100°F (37.7°C), but her day began before dawn and paused at midday. She now sits with co-workers under a neem tree, eating rice and lentils, her loose cotton sari moving with the breeze. As the sun drops, she will return to the fields until dusk. The thermometer shows the same number, but Miguel and Lakshmi inhabit very different heat: one endured under rigid schedules and constraining clothing, the other managed through flexible hours, breathable fabrics, and collective rhythms of rest.



llustrations such as this are commonly found in science textbooks to illustrate how heat impacts human biology.



But in the real world, heat is always culturally mediated through clothing, architecture, technology, and other factors.

The difference in these experiences is cultural. Culture determines the spaces we occupy, the clothing we wear, the value we place on endurance, and our access to cooling or collective care. Therefore, it is imperative to reframe our understanding of heat not as an external force of the natural world, but as something shaped by human activity—and therefore alterable.

There is a growing scholarly interest in the relationships between heat and society in terms of social vulnerability, the built environment, histories of racism, and labor regimes. Yet research in anthropology, architecture, geography, history, and planning still tends to remain in separate conversations, siloed. This fragmentation also occurs in public policy. But people's lived experiences do not follow these boundaries. To this point, a 2023 report from the National Academies of Sciences, Engineering, and Medicine finds that most heat mitigation strategies are reactive rather than proactive—and that "often the solutions are outside of the health system."[3] They call for breaking down silos, developing cross-sectoral solutions, and incorporating meaningful community engagement.

Yet many policy responses have remained narrowly focused on climate metrics and technical fixes, giving less attention to the profound ways that culture mediates how heat is experienced. Just as bodies adapt to heat over time, so do human groups. Across space and time, anthropologists have shown how societies and communities have adapted to heat through settlement patterns, clothing, housing, food choices, and the allocation of labor and time. This report argues that cultural perspectives are not optional add-ons but essential for heat-health planning. While interdisciplinary dialogues are still early, adopting a broader historical and cultural view can shed new light on heat risks and open new solutions.

Why Culture Matters for Understanding Heat

Culture refers to the shared meanings, practices, and values that shape how people interpret their world and act within it. It informs architecture, labor norms, technology, social expectations, and institutions. As a way of experiencing the world, culture also drives creativity and innovation; it is not only an obstacle to health but a source of solutions.

It is often assumed that science and technology can "replace" culture. In fact, science, technology, and policy are themselves cultural. Our understandings of and responses to heat reflect specific norms and assumptions about risk, comfort, efficiency, and value. For example, air conditioning is often seen as a purely technical solution. Yet it emerged from a Western mindset that prized technological control and economic scale over local design. This shift meant that instead of building structures adapted to their environments, architects could use a standardized technology anywhere. While this was celebrated as progress, it also increases energy use and contributes to climate change. Indoor climates now play a large role in shaping how people adapt, sometimes weakening natural thermoregulation. As a result, this technology has displaced other, more sustainable cultures of comfort and adaptation.

Culture also shapes the measures used to understand heat. For example, as detailed in this report, the Heat Index—a metric that merges temperature and humidity data to represent the "feel" of heat—assumes a fit, middle-aged male body standing in the shade as the standard, not the body of an older adult in an unventilated apartment. It does not account for variable insulation from clothing, different activity levels, or exposure conditions.[4] Similarly, metrics like Wet Bulb temperature and clothing insulation values were based on young male soldiers.[5] These assumptions are part of what media studies professor Nicole Starosielski refers to as "thermocultures," the cultural processes of thermal modulation and exposure.[6] In response, a growing number of scholars and policymakers are calling for culturally aware indices, or hybrid tools that combine metrics with ethnographic data and participatory research approaches.

Even widely accepted standards of "thermal comfort," such as the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 55, are based on limited and culturally specific studies—mostly involving young, able-bodied men in temperate zones. Exported globally as best practice, they reinforce a narrow view of comfort and safety. Taking culture seriously means asking: Whose bodies and experiences shape the norms we use to define comfort and risk? Who gets access to comfort—and who is expected to endure? Culture is not just about difference; it is also about power, adaptation, and innovation.

In sum, culture mediates every stage of the heat-health equation, from exposure to adaptation to policy outcomes. As global temperatures rise, fair and effective heat policy requires not only scientific insight but also cultural fluency. It is not enough to measure heat; we must understand how people live with it.

The Syndemic Nature of Heat and Health

The term syndemic, coined by anthropologist Merrill Singer, captures the ways that multiple diseases interact with one another as well as with social and environmental factors.[7] Taking a syndemic approach to heat means recognizing that heat-related impacts—such as dehydration or death—arise not just from high temperature, but from the interaction of environmental stress, bodily vulnerabilities, and social, economic, and cultural contexts.

Physiologically, extreme heat overwhelms the body's ability to regulate core temperature. This can lead to dehydration, kidney strain, cardiovascular stress, heat exhaustion, and in severe cases, organ failure and death. But from a syndemic perspective, the danger is not just biological. Heat's effects are multiplied when combined with existing illness, social inequities, and political conditions.

Heat is often understood as an external stress shaped by temperature, wind, humidity, and dew point. These factors are what make up the "feels like" temperature in weather reports. Yet as the cultural context approach shows, heat is not only about degrees—it is also about norms around clothing, building design, and daily routines.

Vulnerability is unevenly distributed. Older adults, children, and pregnant people are physiologically less able to cope. Outdoor workers, socially isolated individuals, and people with chronic illness are at greater risk. Housing segregation, redlining, and unsafe labor conditions all compound these dangers. Heat-related deaths are therefore not inevitable; they result from policy choices, social arrangements, and design decisions. There is no single technical "silver bullet" solution.

Communities have long managed heat through cultural adaptations. In Bahrain, traditional courtyard homes and shaded streets provided passive cooling. In Mexico and India, siestas and pre-dawn work aligned labor with daily heat cycles. In the Amazon, dietary and social practices supported cooling and rest. These are not just customs—they are cultural technologies developed over generations. Indeed, humans inhabit one of the broadest geographic ranges of any species on the planet, and this has only been made possible by our unique capacities for cultural adaptation and innovation.

The lack of broader recognition of these practices has meant missed opportunities for learning. Many have been displaced by imported technologies or modernist ideals of comfort that can prove counterproductive. In Rio de Janeiro, for example, regular air conditioning use has been shown to reduce people's tolerance for outdoor heat. In other settings, dress codes or sweat taboos restrict effective cooling, particularly for women. Understanding these dynamics is critical for policies that are effective, culturally sensitive, and politically viable.

Social context shapes outcomes as much as physiology. During the 2003 Paris and 1995 Chicago heat waves, older adults and socially isolated people were hardest hit—not just because of age, but because they lacked support networks or safe cooling spaces. In

Central America, agricultural workers face outbreaks of chronic kidney disease likely tied to repeated dehydration and heat exposure during long shifts. In the U.S., racialized patterns of housing and labor continue to expose some groups to greater risks than others.

Mental health also matters. Heat waves have been linked to spikes in hospital admissions for psychiatric emergencies, as well as increases in suicide and aggression. Thermoregulation is tied to brain chemistry, hormones, and hydration, meaning heat can destabilize these systems in subtle but dangerous ways.

This complexity makes it difficult to assign a single "heat threshold" for policy. A wet bulb temperature of 87.8°F (31°C) might be survivable for a healthy young adult at rest, but life-threatening for a postpartum woman, an older diabetic, or a child with diarrhea. In cities like Phoenix, power shutoffs during heat waves can turn survivable heat into fatal exposure.

Understanding heat as a syndemic makes clear that health impacts come from the interaction of biology, infrastructure, and culture. Effective interventions must go beyond lowering temperature to address housing, labor protections, healthcare access, and cultural understandings of comfort. They must also recognize that resilience is not neutral; it is shaped by histories of inequality and current power dynamics. By reframing heat as a syndemic, we can better anticipate impacts, design more tailored responses, and build more just and effective public health strategies.

Reimagining Solutions to Extreme Heat: Adaptability and Cultural Innovation

Many current strategies for dealing with extreme heat are valuable, but they are partial fixes built on twentieth century infrastructures and assumptions. Common measures include energy-efficient housing, reflective roofs and pavements, cooling centers, and adding trees or water features. Public health responses such as checking on neighbors or opening temporary cooling shelters are also important. Some cities have made progress in identifying vulnerable groups like older adults or people without housing. Yet these efforts, while necessary, are not enough on their own. What is often missing are strategies that take cultural and social contexts seriously.

A **cultural contexts of health** approach reframes what is possible:

- *Revealing hidden vulnerabilities:* cultural norms and institutional practices determine who is exposed to heat and how people respond.
- *Increasing effectiveness and sustainability:* policies grounded in local practices and community trust are more likely to last.
- *Promoting equity:* by foregrounding diverse experiences, culturally-informed strategies can close gaps in protection.
- *Changing how we define problems:* seeing heat as co-produced by people and environments opens new pathways for systemic change.

This perspective emphasizes adaptability—solutions that respond not only to changing environments but also to cultural norms and structural conditions as well as to changing biologies across the life course. Such adaptability is essential to address the many ways heat creates risks, and to do so in equitable and effective ways.

At present, however, we lack interdisciplinary models and context-specific data to fully answer how heat operates across buildings, bodies, cultural norms, and economic systems. Because heat rarely causes immediate damage to infrastructure, it is often underrepresented in disaster statistics and health data. Its indirect effects on heart, kidney, respiratory, and mental health are profound but poorly tracked. The fragmentation of knowledge and policy responses makes it harder to create the cross-cutting strategies heat demands. Without reimagining our frameworks, interventions will continue to fall behind the scale of the challenge.

Key Findings and Recommendations for Policy

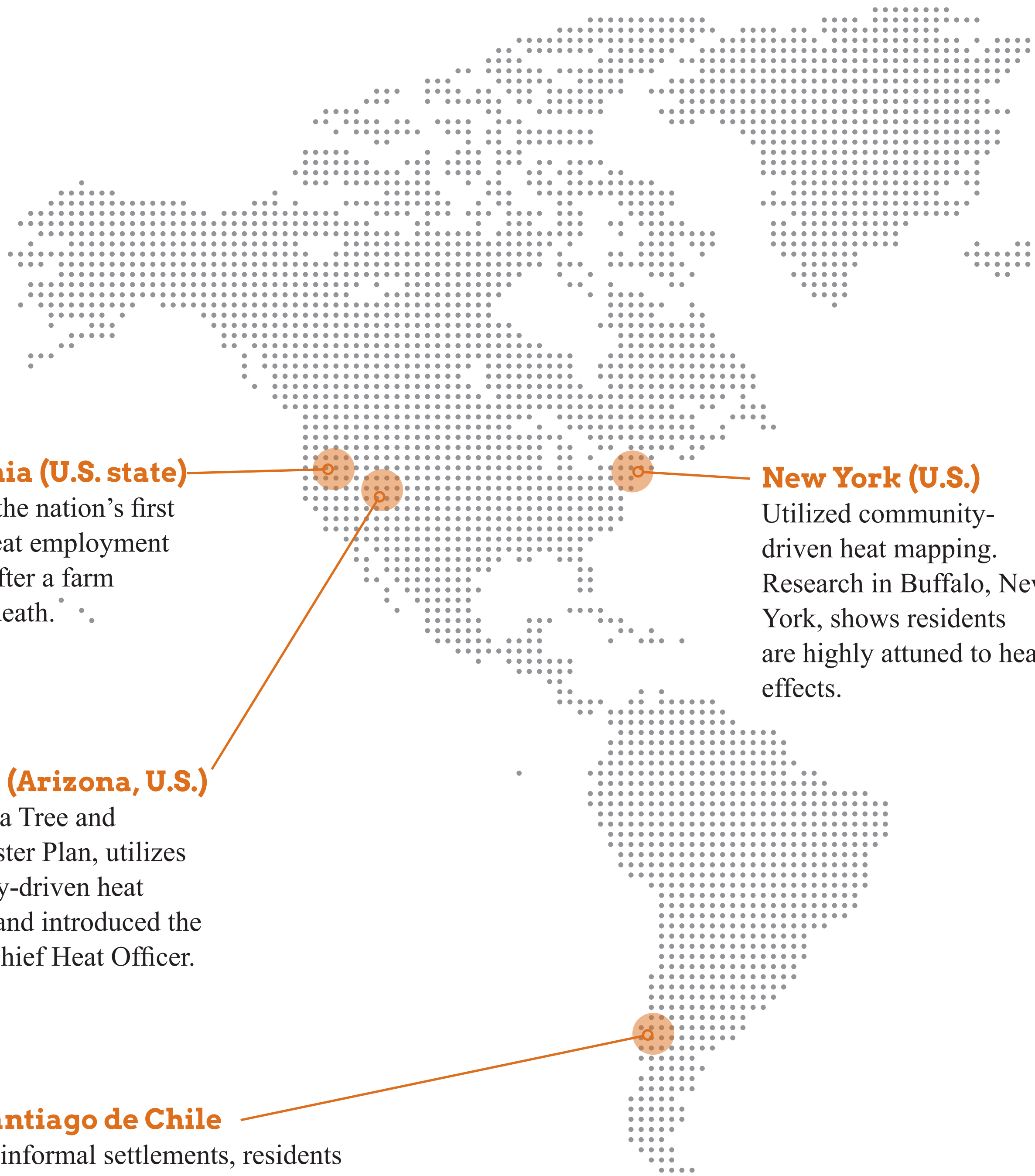
Heat vulnerability is socially produced. This has both analytical and practical implications. Analytically, the heat–health connection is best understood as a syndemic: it arises from the interaction of environmental stress, physiological vulnerability, and social context. The health impacts of heat are shaped by cultural norms that influence buildings, work and rest cycles, clothing, diet, and more. In this sense, heat-related deaths are not "natural" but human-made, structured by policy, design, and neglect in interaction with climate.

Implication	Rationale	Policy Recommendation
Address Uneven Vulnerability to Heat	While heat is often treated as an objective external force, it is actually shaped by how people live, work, and adapt in particular settings. This means that risks vary widely, with outdoor workers and socially isolated people often facing the highest exposure. If vulnerabilities are created, they can also be reduced. Grassroots and locally adapted strategies can provide inspiration.	• Recognize and support community-based adaptations such as passive cooling and culturally appropriate housing designs. • Integrate anthropologists, sociologists, community-based organizations, and local knowledge into heat science and health policy. • Enact policies for heat-sensitive work schedules, especially for outdoor and informal laborers.

Implication	Rationale	Policy Recommendation
Challenge Existing Knowledge Silos	The siloed nature of institutions, a legacy of the twentieth century, means that different agencies often "own" different parts of the heat problem. This fragmented landscape favors universal metrics and ready-made technological fixes, rather than context-specific and cross-sectoral approaches.	• Treat heat as a syndemic issue that cuts across public health, housing, labor, climate, and infrastructure. • Supplement quantitative metrics (e.g., Heat Index, WBGT) with qualitative data to reflect lived experience and cultural expectations. • Avoid over-reliance on technological solutions such as air conditioning, which can exacerbate inequality and environmental degradation.
Reimagine Cultures of Heat	Existing heat indices and standards do not reflect the diverse ways people experience and cope with heat. They are based on narrow, culturally specific models that fail to capture variation in adaptation, physiology, or vernacular knowledge. By revealing Western scientific cultural biases, we can re-imagine what cultures of heat might look like and reframe adaptation beyond technology.	• Move from recognition to collaboration: co-design interventions with communities based on their own priorities and practices. • Shift from individualized solutions to collective, culturally grounded responses, including re-norming around temperature comfort levels. • Employ culturally resonant communication to address cultural narratives that encourage enduring heat, and provide practical guidance on protective action.

Green building in Singapore.

Global Policy Examples

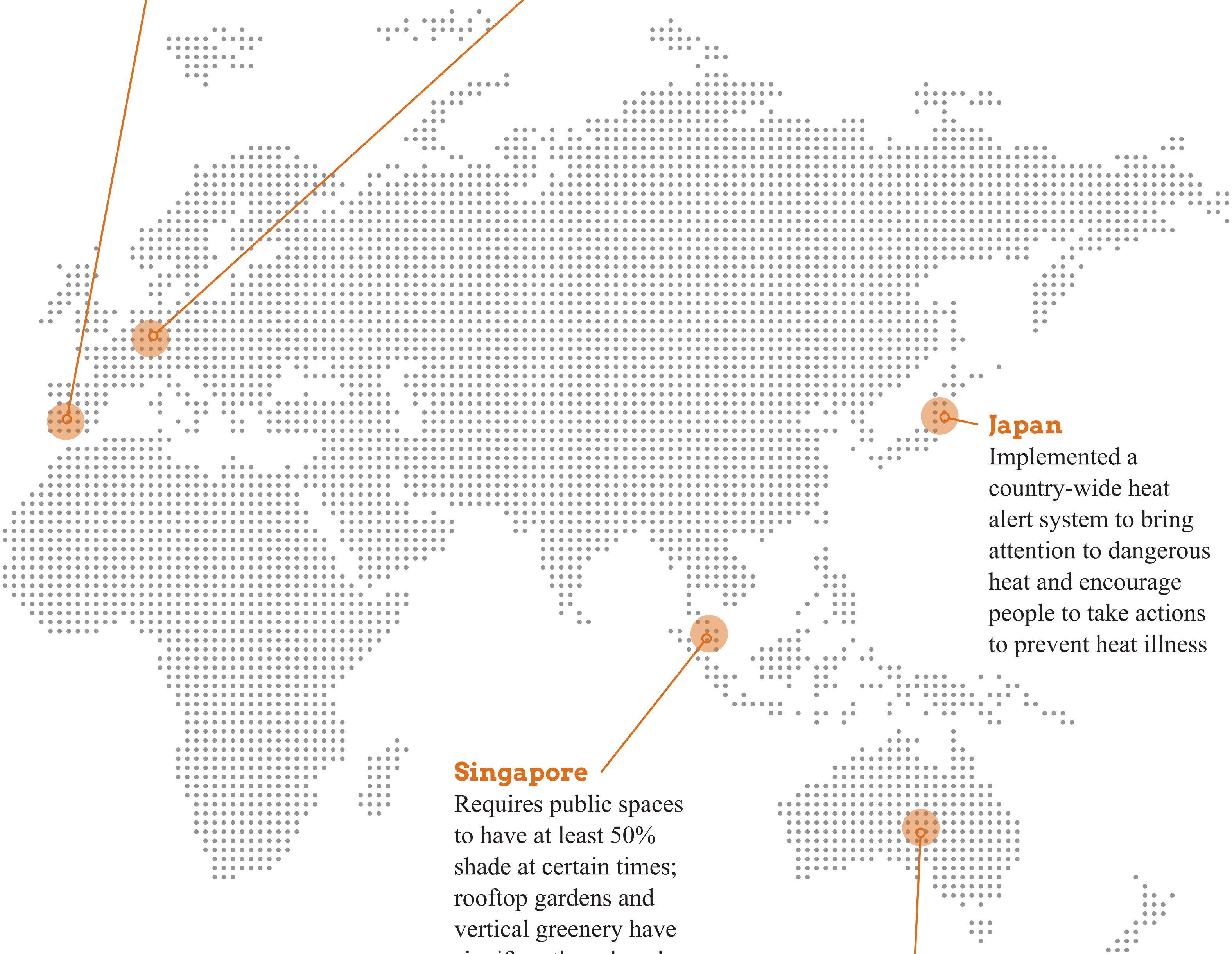


California (U.S. state)
Instituted the nation's first outdoor heat employment standard after a farm worker's death.

New York (U.S.)
Utilized community-driven heat mapping. Research in Buffalo, New York, shows residents are highly attuned to heat effects.

Phoenix (Arizona, U.S.)
Published a Tree and Shade Master Plan, utilizes community-driven heat mapping, and introduced the role of a Chief Heat Officer.

Santiago de Chile
In informal settlements, residents adapted their homes using materials like plastic sheeting to improve insulation, demonstrating bottom-up approaches.



Portugal (Lisbon)
Implemented participatory planning processes involving citizens in urban design and climate adaptation, such as creating shade structures.

Germany (Hamburg)
Promotes community-driven greening projects as part of the Clever City Project to combat urban heating, involving schools, businesses, and citizens.

Japan
Implemented a country-wide heat alert system to bring attention to dangerous heat and encourage people to take actions to prevent heat illness

Singapore
Requires public spaces to have at least 50% shade at certain times; rooftop gardens and vertical greenery have significantly reduced energy demand for air.

Australia
Cities are considering work hour adjustments during heatwaves; construction crews informally adapt to monsoon regions.

Culture Challenges Dominant Understandings of Heat

Heat is both necessary for life and a threat to it. As global temperatures rise, managing the effects of heat on the human body has become one of the most pressing public health challenges of our time. But what, exactly, is heat? The answer may seem self-evident—most of us have an intuitive sense of what heat is and how much is too much for comfort. Yet, to craft effective policy responses, we must have a shared understanding that goes beyond purely biomedical or climatological definitions of heat.

Our perceptions of heat, as well as our strategies to address it, are all culturally mediated. Culture is best understood as a shared, dynamic, and negotiated system of meaning.[8] Crucially, culture is not a list of traits associated with specific ethnic groups; rather, it is the shared and ever-changing set of learned ideas, values, and conventions that inform people's sense of reality and morality. We all have culture and live in a cultural context, creating and reproducing particular ways of being, even in our institutions and research fields—including medicine, public health, and engineering.

The following section reviews the physiological impacts of heat on human bodies, then turns to the limits of our attempts to measure heat and impose universal standards. We show how cultures understand heat differently, and how this impacts their physiological resilience. We conclude that the health impacts of heat are best understood as a syndemic, produced by the confluence of environment, physiology, and contexts. Such an understanding can ground culturally-informed public health approaches attuned to the real, lived dimensions of heat exposure.

Heat as Health Problem

While the human body needs sufficient heat to function, too much heat stresses the body, exacerbating existing medical conditions and potentially resulting in death. By some measures, heat is the deadliest weather-related hazard, with vulnerable populations—such as children, older adults, and low-income communities—disproportionately affected.[9]

Humans are both endothermic (able to produce heat through cellular metabolism) and homeothermic (able to regulate heat gain and loss). Homeothermic control works to sustain a stable core temperature (Tc), the deep internal body temperature, between circa 97°F and 99°F (36.1°C to 37.2°C).

Prologued exposure to excessive heat disrupts the body's thermoregulatory balance, triggering a cascade of biological responses. When core temperature approaches 104°F (40°C), the body begins to show signs of heat stress, including fatigue, dizziness, nausea, and decreased cognitive performance. People can usually fully recover from this condition with cooling and fluid replacement,[10] although the impact on co-morbidities and long-term health are not well studied.

Heat stroke, a medical emergency, occurs when core temperature exceeds 104°F (40°C). Heat stroke can impair the central nervous system, causing potential organ failure and raising the risk of mortality. Above 107°F (42°C), cells start to break down and liquify, resulting in organ failure, stroke, seizures, lung damage, and coma.[11]

The human body uses several mechanisms to dissipate heat and maintain a stable core temperature.[12] These include:

- **Convection:** heat loss via air or water movement across the skin.
- **Conduction:** heat transfer to cooler surfaces.
- **Radiation:** electromagnetic heat loss, especially in shade.
- **Evaporation:** sweat evaporates and cools the skin.

In response to heat, the cardiovascular system increases blood flow to the skin and accelerates heart rate.[13] Blood is diverted from intestines and kidneys to supply the skin and muscles, while maintaining supply to the brain and heart.[14] Heat also triggers stress hormones and proteins that, over time, can worsen cardiovascular or mental health conditions.[15] Without cooling or hydration, these responses quickly become dangerous, especially for those with chronic illnesses like diabetes, kidney disease, or dementia. Infants, older adults, pregnant people, and outdoor workers are at greatest risk because their bodies dissipate heat less effectively.

Sweating is the body's most effective cooling mechanism. The body can produce 1-3.5 liters of sweat per hour. When sweat evaporates, it draws heat away from the skin.[16] But in humid conditions, evaporation slows, and sweat becomes less effective. Above 40% humidity, sweating alone may not protect from heat. Wind helps evaporation, while clothing can block it. For example, heavy uniforms—such as firefighting gear—trap heat, while light, breathable clothing helps cooling. As we discuss in the next section, cultural norms around sweat vary across societies and over time, directly impacting our thermoregulation capacity.

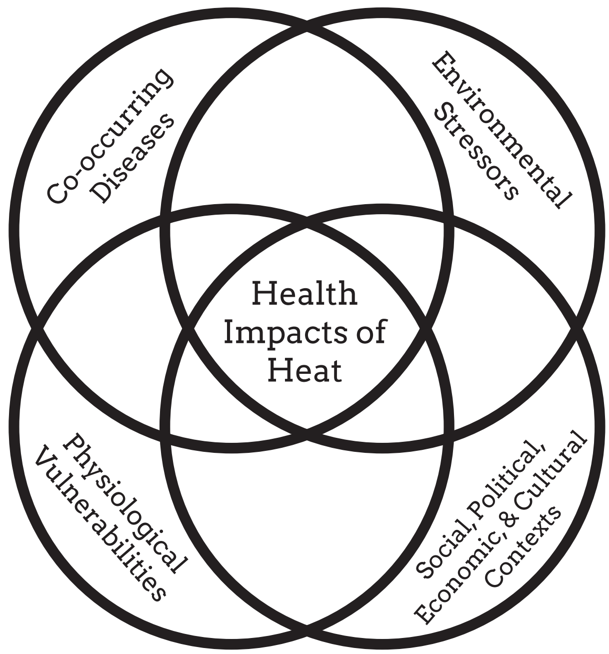
Health Impacts of Heat

- Dehydration results from sweat production without fluid and electrolyte replenishment strains heart and kidneys.
- Heat stroke occurs with body temperatures over 105°F (40.5°C).
- Heat is also linked to ischemic heart disease (heart attack), stroke, respiratory diseases, complications associated with diabetes (usually cardiovascular), and accidents, violence, suicide, and homicide.

The health impacts of heat are not just physical. Studies have also shown a 7.3% increase in mental health-related hospital admissions during heat waves,[17] emphasizing the need for comprehensive planning that includes psychosocial impacts.

Syndemic Vulnerabilities

The term syndemic, coined by anthropologist Merrill Singer, describes how multiple health problems interact with each other and with social and environmental conditions.[18] A syndemic approach to heat takes into account contexts such as social stratification, built environment, and the ever-changing cultural norms that influence people's felt experience of heat. It stresses the interplay between extreme heat and various socio-environmental factors that amplify health risks. This allows us to understand the impact of heat on health beyond mortality. It also allows us to see economic and social conditions as central to vulnerabilities at both individual and population levels.



Thus, temperature alone does not cause heat related illness and death. Chronic diseases such as cardiovascular dysfunction, diabetes, renal impairment, and neurological conditions increase susceptibility to heat stress. So too do age- and sex-related physiological changes that affect circulation, sweating, and thirst regulation.[19] Metabolic rate, hormone cycles, and body mass index all affect thermal load and response.[20] Pregnant women face specific risks due to changes in cardiovascular output, thermoregulation, and fetal-maternal heat exchange.[21] Anthropologist Monica Keith observes that during pregnancy, increased maternal heat load can compromise fetal development, and emerging evidence links extreme heat exposure to higher risks of preterm birth, low birthweight, and maternal complications such as preeclampsia and placental abruption.[22] Infants have immature thermoregulatory systems, high metabolic rates, and limited capacity for sweat-based cooling, while breastfeeding requires skin-to-skin contact and body heat transfer. Older adults often face coexisting medical conditions, reduced cardiac and renal function, and greater social isolation. They are also more likely to live in undercooled spaces or be dependent on caregivers whose labor is itself often invisible and undercompensated.

Mental health conditions—including schizophrenia, anxiety disorders, and substance use—have also been shown to interfere with heat adaptation mechanisms, and heatwaves are associated with spikes in hospital admissions for psychiatric emergencies and increases in suicide and aggressive behavior.[23] The biological mechanisms underlying these vulnerabilities are complex and overlapping: thermoregulation is tied to neurotransmitter activity (e.g., serotonin and dopamine), inflammatory processes, endocrine function, and hydration balance. Heat exposure can destabilize these systems in subtle but dangerous ways, especially when compounded by medication use, poor housing, or occupational stress. Social isolation also plays a significant role, as evidenced by deaths during the 2003 Paris heatwave[24] and the 1995 Chicago heatwave[25], where older adults, poor, and socially isolated were hardest hit.

However, physiological vulnerability alone does not explain who suffers or dies during extreme heat events. Socioeconomic determinants are critical. As Starosielski observes[26], humans occupy zones of thermal privilege and thermal harm, where infrastructures of heating and cooling are distributed unequally. The built environment—shaped by histories of redlining, segregation, and urban disinvestment—concentrates heat in low-income and racialized neighborhoods through the phenomenon of urban heat islands.[27] These same neighborhoods often lack adequate tree cover, access to air conditioning, or safe places to cool down. Heat exposure also intersects with patterns of labor.

Outdoor workers—particularly migrant farmworkers and construction crews—are exposed to extreme temperatures with little protection and few workplace safeguards.[28] In Central America, for instance, outbreaks of chronic kidney disease among agricultural workers—sometimes called Mesoamerican nephropathy—are likely tied to chronic dehydration and heat exposure during physically demanding work.[29] The cumulative impact of heat stress in such settings is not the product of climate alone but of global labor systems, land use, and the dispossession of traditional coping strategies. Language barriers, cultural norms around endurance, and legal precarity all limit the ability of these workers to advocate for safe conditions.

Epidemiological data also reflects this uneven burden. In the U.S., heat-related deaths vary dramatically by race, gender, and socioeconomic status.[30] Physiologically

Factors Contributing to Heat Inequities

Physiological and Demographic Factors

- Age-related vulnerabilities (infants, children, older adults, pregnant people)
- Chronic illnesses (cardiovascular, renal, metabolic, neurological)
- Mental health conditions and medications affecting thermoregulation
- Biological differences not captured by standardized models (sex, body type, fitness level)

Built Environment and Infrastructure

- Redlining and racialized housing segregation producing urban heat islands
- Poor housing quality and inadequate ventilation
- Limited access to green space, shade, and cooling infrastructure
- Location of weather stations (measuring shade/grass vs. sunlit concrete rooftops) that understate local exposures
- Power outages and electricity shutoffs during heat waves

Labor and Economic Systems

- Outdoor, physically demanding, and precarious work (agriculture, construction, delivery, roofing)
- Piece-rate or shift systems that discourage rest or hydration breaks
- Lack of workplace heat protections (in many U.S. states, no enforceable standards)
- Informal labor markets without occupational safeguards
- Migrant workers' legal and economic precarity, limiting ability to advocate for safer conditions

Cultural and Social Norms

- Narratives of endurance ("pushing through" heat as strength; "never let them see you sweat")
- Clothing norms (e.g., modest dress codes, heavy protective uniforms) that restrict cooling
- Stigma around sweat in some societies, reducing willingness to self-cool
- Distrust of official institutions (e.g., reluctance to use government-run cooling centers)
- Gendered and racialized assumptions about who "can tolerate" heat

Institutional & Policy Frameworks

- Reliance on universal thermal metrics (Heat Index, WBGT) that assume a young, male, shaded body
- Air conditioning dependence that creates uneven access and reduces outdoor resilience
- Fragmented "siloed" governance where agencies address pieces of the problem in isolation
- Emergency response systems that treat heat as less urgent than other disasters (tornadoes, hurricanes)
- Incomplete surveillance systems undercounting heat-related illness and death

Global and Historical Dimensions

- Colonial legacies reshaping local cooling practices (e.g., displacement of vernacular architectures by air conditioning)
- Global labor regimes that expose marginalized groups (e.g., Mesoamerican nephropathy among Central American sugarcane workers)
- Climate change amplifying inequities through more frequent and intense heat events

In short: inequities arise not just from **temperature** but from the *intersection of bodies, environments, and power relations.*

and behaviorally, children, older adults, people with mobility constraints, and pregnant women, are more likely to be at risk. Responsibilities of caregiving and occupational hazards associated with labor-intensive jobs further relate to different experiences with heat risk.[31] Perceptual and behavioral pathways also shape outcomes: studies show that low-income individuals report higher levels of thermal discomfort and heat-related illness, but often rely on passive cooling strategies (such as sitting on porch, using fans with wet cloths) that are insufficient to prevent harm[32].

The concept of **thermal insecurity** helps to capture this broader landscape. It refers to the condition of living without consistent or culturally appropriate means to manage heat or cold—whether through housing, social support, or access to utilities. Monica Keith notes that thermal insecurity may manifest directly in cases of heat stroke or indirectly through trade-offs between cooling and other basic needs, such as food, medication, or housing stability.

All of this complicates efforts to assign a single "heat threshold" for policy purposes. A wet bulb temperature of 87.8–89.6°F (31–32°C) may be survivable for a young, healthy adult at rest, but dangerous for a postpartum woman, a diabetic older adult, or a child with diarrhea.[34] In cities like Phoenix, electricity shutoffs during heatwaves can be fatal, yet policies often fail to protect those who cannot afford continuous access.

While the syndemic nature of heat complicates data collection, making it difficult to isolate the effects of heat, understanding these overlapping impacts can help guide better policies. Taking a syndemic perspective on heat underscores a central point: heat stress results not from any single variable but from the interaction of biological, infrastructural, and cultural domains.

Interventions must go beyond temperature reduction strategies to address housing quality, labor protections, health care access, and cultural understandings of thermal comfort. They must also recognize that "resilience" is not a neutral term; rather, it is shaped by histories of inequality and current configurations of power. By reframing heat not as a discrete hazard but as a syndemic condition, we can better anticipate its impacts, tailor our responses, and work toward more just and effective public health strategies.

Measuring Temperature and Feeling Heat: The Limits of Metrics

Standard approaches to heat rely on numbers—air temperature, heat indices, and humidity levels—to determine risk thresholds and guide policy. These metrics are useful, but they only tell part of the story. Human heat experience emerges from a dynamic mix of physiology, context, and culture. As Nicole Starosielski notes, the idea of "thermal objectivity"—that temperature is an independent fact—is misleading, because it leaves out how people actually feel and respond to heat.[35]

Focusing on a single temperature value ("it's 95°F [35°C] outside") obscures how that heat is actually felt and managed by different people. Temperature is an average of thermal energy in a mass, measured by thermometers (in degrees Celsius, Fahrenheit, or Kelvin). It tells us about the external environment, not about how humans experience it. The temperature of a city park is different from a sunbaked rooftop, but official readings may miss those variations.

Heat, defined as energy transfer, is not the same as temperature. A given temperature can affect individuals in vastly different ways depending on their physical condition, clothing, activity, and even expectations. In other words, heat is not simply a number on a scale; it is the lived experience of thermal exchange, co-created by humans and their environment. The temperature of the earth's surface does not describe heat-—heat becomes meaningful only through human interaction with temperature.

While temperature is useful, it does not fully explain health impacts; various bodies experience heat differently and in different contexts. A given reading can affect people differently depending on clothing, activity, or expectations. For example, 95°F (35°C) may be manageable for a healthy young person resting in the shade, but dangerous for an older adult in a top-floor apartment. Relying solely on thermometric measures to describe heat and cold separates these experiences from human contexts.[36]

Modern meteorological measures like the Heat Index (which combines temperature and humidity) attempt to translate metrics into something closer to felt experience (the "feels

Measuring Temperature: A Brief History

Understanding the limits of temperature measurement helps show why we need lived experience alongside numeric data. The radiation of heat transfer can be measured as temperature using various technologies, from simple thermometers to infrared satellite cameras.

- Galileo's thermoscope (c. 1593) detected temperature shifts but had no scale.[37]
- Daniel Gabriel Fahrenheit (1714) invented the mercury thermometer with fixed points (freezing at 32°F, boiling at 212°F).
- Anders Celsius later created his scale, boiling point of water at 0° and the freezing point at 100° (now reversed).

By the twentieth century, governments sought more precise measures of heat stress. The U.S. military developed the Wet Bulb Globe Temperature (WBGT) to better assess heat stress. Historian Gregory Chamayou traces its history to early twentieth century studies of working conditions in British mines and textile mills.[39] In these places, wet temperature, not dry air temperature, was the critical factor in determining the physiological impacts of heat.

Industrialists then used thermal metrics to maximize productivity.

Wet Bulb Globe Temperature is measured using a thermometer wrapped in a wet cloth, exposed to airflow. It captures the cooling efficiency of evaporation as well as air temperature. When WBGT nears 95°F (35°C), the human body struggles to cool itself by sweating. Some studies suggest dangers start even lower (87.8°F [31°C] or below for vulnerable groups).[40] WBGT is used by the U.S. Occupational Safety and Health Administration (OSHA), the military, and international bodies to guide work/rest cycles and risk alerts.

In the U.S., meteorology became standardized in the nineteenth century, driven by public health efforts to correlate weather with illness.[41] By the late nineteenth century, weather forecasting and climatology had diverged, developing distinct methods and data sources.[42]

like" temperature). One promising alternative is the Universal Thermal Climate Index (UTCI), which seeks to accurately capture human physiological reactions to a multi-dimensional actual outdoor thermal environment. It proposes a more nuanced single figure to capture how human bodies experience thermal exchange in a "universal" manner.[43]

Even these refined indices treat heat as an external force. They leave out the nuances of *thermoperception* – the sensory and cultural perception of heat and cold. All temperature measurements are approximations, and it is easy to forget their inherent limits. A city's official air temperature, for instance, might be taken in the shade above a grassy lawn, but a worker on a sunbaked concrete road or a resident in a poorly ventilated top-floor apartment will experience something far more intense.

Heat policy prioritizes objective meteorological data over subjective sensory experiences. But by narrowly defining heat as a meteorological state, our standard instruments and indices risk making invisible the human experience of heat and the social drivers of heat vulnerability.[44] Abstract temperature data divorced from context can hide crucial variability in how heat is actually felt across different settings and communities. In one Israeli city, for example Eastern European women find it hotter than local men.[45] Indeed, public health experts note that some dangerous effects of heat (such as cognitive impairment or heat stress indoors) are not adequately captured by existing indices. In short, a fixation on metric thresholds – while important for consistency – may blind policymakers to on-the-ground realities.

Historically, weather and climate sciences prioritized commerce and property over human comfort.[46] That legacy continues today when policies focus only on lowering outdoor temperatures, such as by planting trees or building cooling centers. These are valuable steps, but focusing only on thermometer numbers risks missing how and where people actually experience heat. Critical heat scholars have even described extreme heat exposure under status quo policies as a form of "institutionally sanctioned violence," because overlooking social context allows preventable suffering in marginalized communities.[47]

The bottom line: metrics are necessary, but never sufficient. To design fair policies, we must look beyond averages and indices to consider how heat is lived and felt among different populations and in different settings. This means bringing cultural and subjective dimensions of heat into view, rather than treating heat simply as just a statistic. A cultural approach such as ours aims to understand heat as a felt experience, and explore how factors like race and social separateness influence urban management practices that produce and obscure heat inequity.

Heat Vulnerability (and Heat Vulnerability Indices)

At midday in Phoenix, a construction worker braces against the heat radiating from concrete as the thermometer hits 105°F (40.5°C). His hard hat and reflective vest trap warmth, and short breaks at water coolers do little to offset the strain. In Dhaka, a garment worker labors inside a crowded factory at the same temperature, where fans cut in and out during power shortages and the air grows stagnant. In both cases, workers face the same temperature, but the risks differ: one from direct sun and radiant heat outdoors, the other from poorly ventilated, enclosed spaces.

Governments and NGOs increasingly use sophisticated metrics to assess heat as both a health risk and a lived experience. Journalist Michael Coren (2023) notes that more than 300 heat stress indices are in use worldwide, each offering a slightly different way to interpret danger.[48] Among these tools, Heat Vulnerability Indices (HVIs) have become central for identifying and addressing unequal risks of heat exhaustion, stress, or stroke.

HVIs model vulnerability as a mix of three elements:[49]

- **Exposure:** how much and where heat is felt, often measured through surface temperatures or urban heat islands.
- **Sensitivity:** who is most physiologically susceptible, based on conditions like cardiovascular disease, diabetes, or obesity, as well as prior climate experience. For example, people in cooler regions may be more sensitive to sudden heat than those accustomed to hotter climates.[50]
- **Adaptive capacity:** the resources people have to cope, such as air conditioning, social networks, or public cooling centers.[51]

Sensitivity and adaptive capacity together are often called "social vulnerability." HVIs are useful for mapping this, but they also raise questions. Too often, anthropologist Ashley Carse and Zachary Wampler argue, vulnerability is treated as a technical category rather than as something shaped by politics and society.[52] For example, "adaptation" is sometimes reduced to proxies like social capital or community trust—crucial but hard to capture in data.

HVIs are also often applied at the individual or neighborhood scale without fully considering how heat is shaped by larger systems: housing, infrastructure, and transportation. Research shows that redlining, housing segregation, and unequal tree cover directly affect who gets the most exposure and who has the least capacity to adapt.[53] These patterns also influence human behavior and perception, yet biophysical models often miss them.

Planning scholar Zoé Hamstead calls this condition thermal insecurity: living without consistent or culturally appropriate ways to manage heat or cold.[54] It shows up both directly (through higher health risks) and indirectly (when people must choose between cooling and other essentials like food, medicine, or rent). HVIs can reveal where these pressures are greatest, but without cultural and qualitative insights, they risk oversimplifying complex social realities.

HVIs remain vital for public health and urban resilience, but they need refinement. That means improving their technical rigor while also expanding them to include cultural, behavioral, and political dimensions of adaptation. Only by opening up the "black boxes" of vulnerability and adaptation can responses to extreme heat become more just and effective.

In short, heat metrics are necessary tools, but they can mislead if treated as full representations of reality. Every measurement is an approximation. To understand heat properly, we must also see how people create, endure, and adapt to it in daily life.

Laboratory v. Real Life: Standardized Bodies and Temperatures

Anthropologist Monica Keith observes that most scientific research on heat stress comes from exercise physiology and short-term studies in controlled environments.[55] Subjects are placed in thermal chambers, fitted with sensors to measure body temperature, heart rate, and sweat production as they exercise in rising heat. These studies produce valuable insights, but they flatten the diversity of real-world experiences.

"These controlled studies can only include 'healthy,' non-pregnant adults of a certain age range who can withstand intense exercise and exposure to extreme conditions for experimental purposes. This body of research is not at all representative of human biological variation across most dimensions and therefore limits our fundamental understandings of thermoregulation and risk in critical ways."

—Monica Keith

Field-based research—where people are studied in the settings where they actually live and work—adds crucial nuance. For example, outdoor conditions measured by weather stations often do not match what residents experience indoors. Planning scholar Zoé Hamstead notes that indoor temperatures in poorly ventilated apartments can be far higher than the official outdoor reading.

New tools like wearable sensors now capture detailed information on specific groups, such as farmworkers. These devices record air temperature, humidity, body temperature, and heart rate throughout the day. Such data are promising, but without attention to cultural and social factors—like work routines, clothing, or community norms—they can miss the bigger picture of how heat is lived.

Despite wide variability in heat perception, universal standards of comfort prevail. In the U.S., the Occupational Safety and Health Administration (OSHA) recommends indoor workplace temperatures between 67–76°F (20–24°C). These standards were originally based on a model subject: a 44-year-old man weighing 154 pounds.[56] This model of "broadcast temperature" assumes a stable, uniform temperature for all occupants, which does not reflect the diverse thermal needs of different bodies.

Similarly, in Bahrain, engineers rely on standards published by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). These guidelines, also rooted in U.S. office-worker data, are applied even in hot, arid climates where cultural norms and conditions differ.[57]

Thermal Comfort and ASHRAE Standards

The American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) defines indoor thermal comfort using Standard 55. This model is widely used in architecture, public building design, and workplace regulations around the world. ASHRAE 55 defines thermal comfort as "that condition of mind that expresses satisfaction with the thermal environment." It relies on six variables: air temperature, radiant temperature, humidity, air speed, activity level, and clothing insulation. Its foundational model was developed in the 1970s by Danish engineer Povl Ole Fanger, based on experiments with young white men.

The standard assumes "comfort zones" that should satisfy 80% of building occupants. A newer "adaptive model" accounts for behaviors like opening windows or adjusting clothing, but assumptions still largely reflect Euro-American office culture.[59] This means recommended workplace temperatures may not fit people from warmer climates or those whose clothing limits cooling. Comfort standards do not only measure needs—they also shape expectations about what counts as normal.[60]

Starosielski calls this kind of standardization "thermal objectivity"—the attempt to fix comfort through universal numbers.[58]

The scientific community has historically paid limited attention to the contextual settings where people actually experience heat. Standardized bodies and temperatures prevail. A more inclusive approach would combine physiology with culture, recognizing that norms of comfort and safety are shaped by context and history, not by universal bodies. By applying a cultural lens, we can better understand how high temperatures are experienced—and design responses that reflect this diversity.

Cultural Meanings of Heat: Thermal Perception Around the World

Science can explain how heat affects the body, but culture shapes how people sense, interpret, and respond to heat every day. Around the world, communities have developed very different ideas of what "hot" and "cold" mean, often challenging the universal assumptions of Western medicine and meteorology.

The concept of thermoperception refers to how people learn to feel and make sense of temperature through cultural lenses.[61] Ethnographic studies show that heat is not just physical, it also carries social and symbolic meaning.[62] In many languages and traditions, "heat" is intertwined with ideas of health, vitality, spirituality, and status. These cultural frameworks profoundly influence what counts as safe or dangerous heat, and how people adapt to it.

For example, the Tzotzil Maya in highland Chiapas, Mexico, live in a "thermal cosmos" where everything contains heat.[63] The sun is "Our Father Heat," the ultimate life force. Social hierarchy and life stages are described in thermal terms: babies are "cold" and weak, but accumulate heat through rituals and milestones, reaching their peak just before death. Illness, too, is explained in terms of imbalance, with healers adjusting the body's heat through diet, herbs, or ritual. Here, what biomedicine calls heat illness is treated as a disruption of a spiritual-thermal balance. The Tzotzil experience of heat is deeply cultural: it is felt in the body and understood through cosmology and ritual, not just read on a thermometer.[64]

In Hawaiʻi, Native traditions viewed cold as an important part of the islands' environment. Places like Mauna Kea, where water freezes, were revered, but colonizers imposed a cultural bias that saw Hawaiians as belonging only to warm climates.[65] This served as justification to dispossess communities from cooler highlands. Later, the arrival of ice and refrigeration reshaped diets and practices, becoming tools of colonial power, as shown in the work of Hiʻilei Julia Kawehipuaakahaopulani Hobart, a professor of Native and Indigenous Studies at Yale University. Today, Native Hawaiian activists are reclaiming traditional knowledge of winds and cooling to challenge these colonial legacies.

Cultural differences in thermal perception are also evident in how communities adapt (or fail to adapt) to hot conditions. In the Middle East, communities have long adapted to extreme heat through architecture (such as wind-catching towers) and daily rhythms of work and rest. But in 1920s Palestine, new arrivals from Europe responded to heat by wearing shorts—seen locally as immodest and provocative. What seemed like a practical adaptation to newcomers clashed with cultural expectations, showing how heat can become entangled in politics, gender, and identity.

What the newcomers viewed as a simple coping strategy for heat was, in the eyes of long-time residents, a provocation.[66] Misunderstandings over how to live with heat fueled tensions that contributed to broader conflicts. Heat, in this case, was an active factor intersecting with gender norms, colonial politics, and identity. It underscores that thermal perception is acquired: we learn what level of heat is normal, acceptable, or dangerous from our culture and experience, and we learn how to manage it. A temperature that one group finds intolerable might be routine to another group in the same place, and effective policy must take these differences into account.

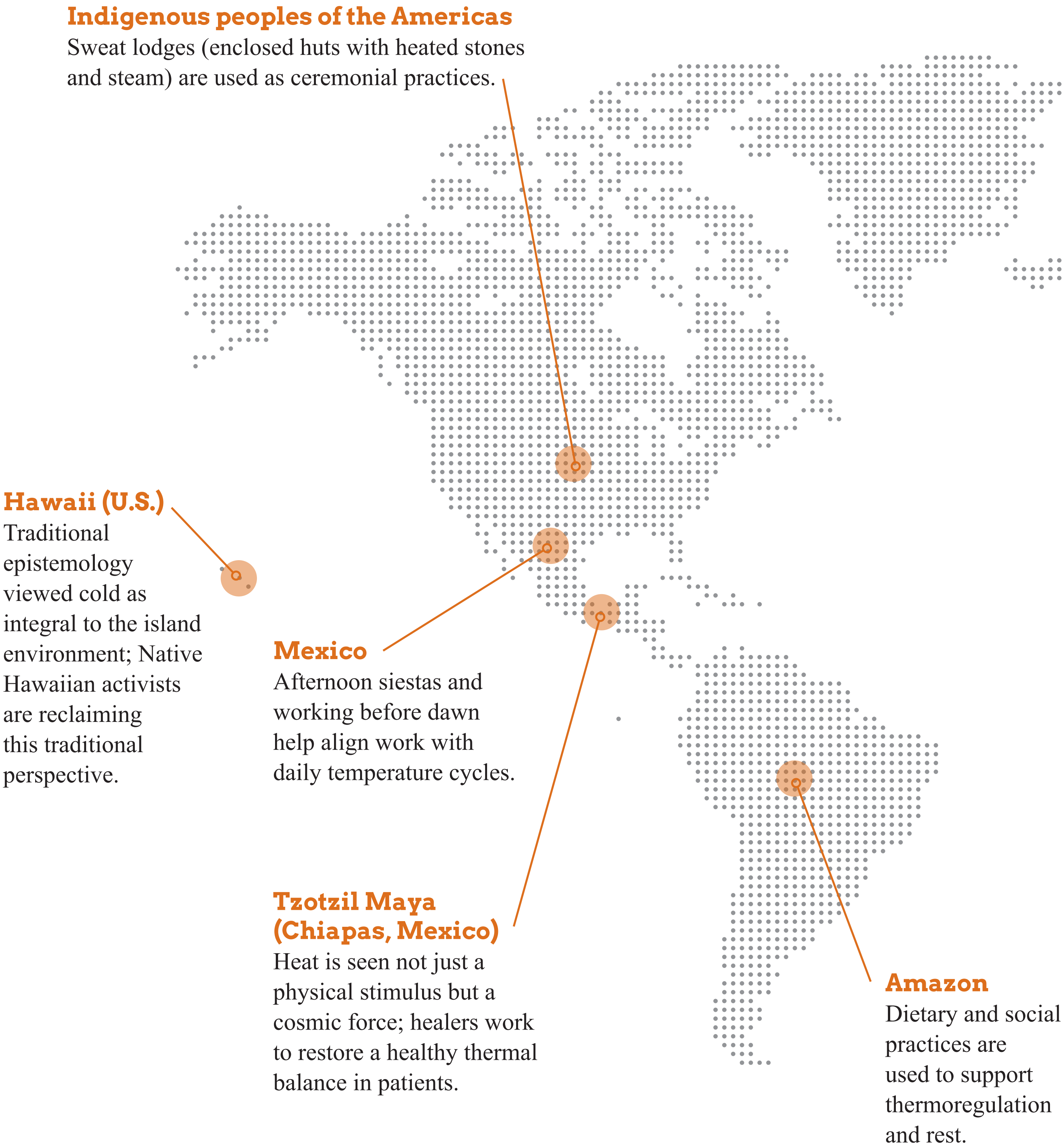
Traditional Chinese medicine (TCM) offers another example. It treats disease in terms of hot–cold balance in the body. During COVID-19, Chinese health authorities described the virus as a "Cold-Damp epidemic," leading to public health responses that included warming herbs and heat therapies alongside biomedical treatments.[67] This shows how cultural frames continue to guide health practices, even in modern crises.

Even within industrialized societies, attitudes vary. In Finland, sauna culture embraces extreme heat as purifying and restorative.[68] There are millions of saunas across the country in homes, workplaces, and even parliamentary buildings. Similarly, Indigenous peoples across the Americas use sweat lodges as spiritual and physical renewal. In contrast, in U.S. workplaces, heat is often seen as something to endure. As journalists Umair Irfan and Aja Romano note, heat is linked to strength and toughness—pushing workers to keep going even when unsafe.[69] Migrant and low-wage workers, in particular, are pressured to ignore discomfort, raising their risk.

These pressures illustrate how cultural narratives can amplify risk, making it all the more important for policy to acknowledge and adapt to them. Policymakers should note that communities may have their own trusted heat adaptations (like midday siestas, sirocco wind rituals, or cooling herbal drinks) which ought to be respected and, where appropriate, incorporated. We go into more detail about this in the following section.

"In many languages and traditions, "heat" is intertwined with ideas of health, vitality, spirituality, and status. These cultural frameworks profoundly influence what counts as safe or dangerous heat, and how people adapt to it."

Global Examples of Cultural Adaptations to Heat



Finland

The culture of the sauna, where exposure to extreme heat is seen as curative and relaxing (176°F [80°C] steam), is a deeply ingrained tradition.

Iran

Architects are resurrecting traditional wind-catching towers, an architectural adaptation to hot climates.

Chennai (India)

Poorer communities arrange their days around the heat and using practices like consuming cold rice porridge and watering roofs.

Tanzania

A group redesigned bricks to allow airflow, cooling interiors, and even disrupting the flight patterns of disease-carrying insects.

Bahrain

Modern architects are incorporating traditional elements like inner courtyards to enhance shade and ventilation in low-carbon designs.


BACK IN
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Culture Mediates Heat

Culture is woven into political, economic, religious, psychological, and biological life.[70] It shapes not only how people make sense of the world but also how they experience heat. From this perspective, heat stress is never just about the body's limits; it is also about cultural values of productivity, cleanliness, endurance, and comfort.

Culture influences how we adapt to heat through clothing, architecture, food, work rhythms, and technology. Even technologies like air conditioning emerge from specific cultural values—in this case, preferences for control, enclosure, and uniform comfort. In short, culture *mediates* between bodies and environments, shaping both risk and response.

Nicole Starosielski calls these "thermal cultures": patterned ways that groups learn to experience and manage temperature.[71] In the twenty-first century, thermal cultures are highly technological, often taken for granted. But they still determine what we consider tolerable, desirable, or dangerous.

Air conditioning is the clearest example. It has spread worldwide—though unevenly— enabling new ways of living and working in hot environments. More than a technical transformation, it is a cultural force that has reshaped norms around comfort and introduced new vulnerabilities to heat—both social and environmental.

In this section, we explore a range of cultural practices—including architecture, clothing, food, and work rhythms— that illustrate alternative ways of living with heat. Then, we examine air conditioning as a case study of how cultural expectations around temperature and comfort mediate heat exposure and adaptation. Finally, we reflect on the concept of adaptation itself and propose cultural mediation as a broader, more nuanced concept in the face of rising temperatures.

Cultural Adaptations

At midday in southern Spain, shops close and streets empty as temperatures climb above 100°F (37.7°C). Families retreat indoors, shutters drawn, to rest through the hottest hours. Work resumes in the cooler late afternoon and stretches into the evening. In Cairo, by contrast, summer nights often spill onto rooftops. Families bring mats upstairs, sleeping under the open sky where breezes flow more freely than in crowded apartments. Both the siesta and rooftop sleeping are cultural adaptations developed over generations. They make heat livable without machines—by restructuring time and space around the climate.

Heat may be a common human experience, but the ways that people cool down are deeply cultural. From housing and architecture, to food and clothing, to language and labor systems, societies adapt to heat in ways that are place-specific and woven into the broader fabric of life.

Architecture

Historically, architectural practices tend to reflect available natural materials, local climate, and cultural preferences in a specific place. In hotter climates, housing design was more likely to accommodate heat—including differences for dry, desert climates; wetter, more tropical climates; or climates with distinct seasonal differences. Globalization, however, challenges previous adaptative norms. Today, cultural preferences, aesthetic trends, and modern technologies as well as the global availability of building materials tend to dominate building decisions rather than adaptations to the natural environment as it is. Traditional architecture in hot climates often included features like courtyards, wind catchers, or shaded alleyways to cool interiors.[72] In Bahrain, for instance, houses were designed around courtyards that promoted air circulation and positioned to minimize sun exposure, with rooftop areas for sleeping during the hottest months. This architectural wisdom, coupled with lifestyle patterns like sleeping on rooftops, demonstrates a holistic approach to living with heat.

Wind-Catchers

A wind catcher consists of a tall tower with openings oriented toward prevailing winds. The structure funnels cooler outside air down into a building, while warmer indoor air is pushed out through other shafts, creating natural ventilation. By harnessing differences in air pressure and temperature, wind catchers lower indoor temperatures without mechanical systems.

Even in climates that have cooler environments or four seasons, heat remains a key part of architectural considerations. In traditional northern Chinese houses, the *kang* was a raised radiant floor-bed that localized heat in one part of the room, while Japanese homes often centered a fireplace that served both as a heating source and a social hub.[73] Berardo Matalucci and colleagues describe the thermal environment of Japanese homes as conveying "sacredness, pleasantness, and delight, resulting from the contrast between cold–warm experiences, rather than its uniformity."[74]

Food

Food practices also help people cope with heat. In Chennai, poorer communities organize their day around heat patterns, and eat cold rice porridge to cool the body. Spicy foods, common in hot climates, trigger sweating, which aids cooling, while also protecting food from spoilage.[75] What may look like taste preferences are often practical adaptations to the environment.

Clothing and Sweat

Clothing norms strongly shape heat experience. Loose, breathable fabrics allow cooling, while heavy or restrictive clothing raises risk. Cultural preferences for modesty or fashion may hinder thermoregulation, particularly among women and outdoor workers.

Sweat is the body's most vital cooling mechanism, yet its meanings vary. In some societies, sweat has been seen as healthy;

Vernacular Architecture in Bahrain

The anthropologist Marwa Koheji has shown that a wave of Middle Eastern architecture draws on cultural heritage to create low-carbon designs that challenge reliance on air-conditioning.[76] Architects in Bahrain are incorporating traditional elements such as inner courtyards to enhance shade and ventilation, and experimenting with wall thickness to improve thermal resistance. Traditionally, houses were arranged around an open, central courtyard that provided shaded areas during the day and promoted air circulation. Houses were oriented according to sun and wind paths and were arranged along narrow alleyways to minimize the space exposed to the sun. This was all within living memory. One native of Muharraq City recalled, "It's not that it wasn't hot, or we never felt the heat, but we learned how to live with it. We built our houses well." And it wasn't just the architecture but also the patterns of life. "We slept on rooftops because they were cooler spaces, and our houses had wind-catchers built into them. Some people would migrate near the coast during the summer as well and live in palm-frond huts. We knew how to cope with the climate."[77]

in others, it has been stigmatized. In the Middle East and Europe, people historically perceived sweat as beneficial and desirable to expel toxins from the body. But by the nineteenth century, body odor became associated with poverty as bathing practices changed among the upper classes. Within this context, sweat became stigmatized. These cultural attitudes influence who can cool effectively, and who cannot.

With the widespread acceptance of germ theory, increased urban density, and the rise of corporate culture in the twentieth century, a growing disdain for body odor began to take hold.[78] The commercialization of anti-sweat products played a significant role in changing societal norms.[79] Advertisers capitalized on societal insecurities, particularly targeting women by convincing them that sweat and odor were embarrassing and undesirable. In more recent decades, individuals have even sought to control sweat through medical interventions like Botox injections and beta blockers,[80] reflecting ongoing cultural discomfort with visible sweating and the lengths to which individuals will go to suppress it.

In Japan excess sweat is often associated with negative attributes such as being "fat, dirty, lazy" and is generally only seen as acceptable in physically fit individuals who are exercising. Anthropologist Alexandra Brewis notes how the Japanese view overweight men and their sweat as particularly disgusting.[81] In this region, disposable sweat sheets are commonly used to manage perspiration.

In sum, different regions and cultures have different ways that they adapt their habits—including architecture and infrastructure, food, clothing, and sweating—to heat. These are technical solutions that emerge from a particular cultural context. When a technical solution comes from outside a particular context, it does not always work. For example, Swahili-style houses in Tanzania traditionally made from earth brick often have sealed up windows help keep mosquitos out; unfortunately, in a warm climate, this also kept too much heat in. When cheap screens were made available to improve air circulation, they lacked local uptake.

In this case, a group of anthropologists, architects and public health experts worked together with local communities to design a solution that would decrease heat and keep out mosquitos. Walls tend to be viewed as barriers, serving to separate and insulate, but this group reimagined them as a means of filtration. Thus, they successfully adapted the local brick's properties to allow airflow, thereby providing cooler interiors and while still keeping out disease-carrying insects.[82]

Similarly, modern Western technologies such as air-conditioning are a product of a cultural context.

Air Conditioning, Comfort, and Adaptation

"When we turn our attention to the interior, the familiar ways of knowing and interacting with the climate—mitigating, adapting, even observing—start to lose their purchase... Interiors are not so much containers as they are points of dense convergence—never stable always leaky" (Nading, Besky, and Cons).[83] Air conditioning has reshaped how people live with heat. In the U.S., its spread in the twentieth century enabled new building styles and supported migration to hotter regions. In the Middle East, it arrived through colonial and industrial expansion, replacing older cooling practices. In both regions, air conditioning has transformed social life, separating people into enclosed, private environments.

Reliance on AC, however, often widens inequalities. Those who can afford it insulate themselves from heat, while others must endure outdoor or poorly cooled conditions, reinforcing social hierarchies. AC dependence also reduces people's natural heat tolerance, making them more vulnerable when cooling fails.

The advent of air conditioning in the U.S. began in 1902 when Willis Carrier developed the first modern air-conditioning system to control humidity in a New York printing plant. Initially used in industrial and commercial settings, air conditioning spread to commercial venues such as movie theaters, department stores, and restaurants in the 1920s. By the 1950s, it was more common in private homes, though this varied by region, with homes in the cooler parts of the north less likely to have air conditioning units or central air. By 1970, 37% of U.S. homes had some air conditioning and, by 1980, the number reached 57%.[84] This transformation shaped not only building design and work environments but also the migration of industry and populations, especially to the U.S. Sun Belt.[85] Today, nearly 90% of households in the U.S. use some type of air conditioning technology.

Air conditioning has had a different trajectory elsewhere. Anthropologist Marwa Koheji observes that air-conditioning "only produces expectations of comfort, but it can shape users' culture and the places it becomes part of."[86] In the Middle East, people have historically adapted to extreme desert heat through architectural designs, work patterns, and daily rhythms. However, the advent of air conditioning marked a significant shift.

Air conditioning arrived in the Middle East alongside capital expansion and imperialism. It was introduced by U.S. engineers searching for oil in 1934 and subsequently spread by British colonial administrators.[87] In the British Middle Eastern colonies, the expansion to air-conditioning followed a trajectory similar to that of the U.S.: it was introduced in movie theaters and other public spaces in the 1940s, and by the 1950s, had moved into domestic spaces. This technological adoption was central to British colonial rule, leading to architectural changes that displaced traditional cooling methods. It also led to changes in cultural patterns such as midday naps, sleeping on the roof at night, and attitudes toward perspiration.

Anthropologists have observed some of the less obvious impacts of these changes. Writing of Egypt, historian On Barak describes how the use of air conditioning in private homes led to the phenomenon of "sphering," where individuals insulate themselves in closed bubbles, separating from the communal experience of heat.[88] This means that the management heat itself becomes a decentralized, privatized endeavor instead of a communal effort. Another good example of this comes from Madlen Kobi's study of Chongqing, China, which focuses on the city's transition from traditional, naturally ventilated wooden and bamboo dwellings to high-rise concrete buildings since the 1980s.[89] This shift, driven by rapid urbanization and electrification, led residents to increasingly rely on air conditioning for thermal comfort. However, the transition displaced communal, outdoor cooling practices—like sleeping on rooftops and gathering in shaded courtyards—which in turn impacted social, economic, and political life.

As the linkage between air conditioning and colonialism and rapid urbanization suggests, cooling technologies are linked to power relations.[90] Today, reliance on air conditioning exacerbates social divides. Some can afford to retreat into private, air-conditioned spaces, insulating themselves from the communal experience of heat. Others cannot. In the contemporary Middle East, as Koheji notes, this reproduces the social divide between migrants and citizens by associating migrants with sweaty and odorous bodies unworthy of inclusion.[91] In Chongqing, rapid urbanization also created a socioeconomic divide in access to cooling.[92] Additionally, power outages can exacerbate this issue, as seen in post-Katrina New Orleans.

In short, while air conditioning saves lives and is often treated as the default response to extreme heat, it should be seen as a temporary and partial measure—not the foundation of heat adaptation policy. Overreliance on AC creates a cycle of inequity and environmental strain:

- **Equity:** Access to AC depends on income, housing, and reliable electricity. Those most vulnerable to heat are often least able to afford or use it.
- **Environmental impact:** AC contributes to greenhouse gas emissions and urban heat island effects, worsening the very problem it seeks to address.
- **Reduced adaptability:** Constant reliance on cooled interiors lowers physiological acclimatization, leaving people less able to cope with outdoor heat.
- **Infrastructure stress:** Widespread AC use increases energy demand, risking blackouts that are most dangerous during heat waves.
- **Cultural displacement:** AC has replaced long-standing, low-energy cultural adaptations (such as shaded courtyards, siestas, and vernacular architecture) that offer more sustainable solutions.

Lasting solutions will require investment in equitable design, community-based adaptation, and cultural practices that support resilience without deepening divides.

Cultural Norms of Comfort

Comfort is not a universal standard. It is culturally shaped. Air conditioning has raised expectations of cool indoor environments, ,[93,94] sometimes erasing traditional practices like rooftop sleeping or siestas.[95] Just as these older practices were unlearned, thermal cultures built around AC can also be changed. This speaks to the potential for "**renorming**" thermal cultures.

Thermostats

The introduction of the thermostat dial transformed temperature from a subjective experience to a quantifiable measure, raising questions about how our perceptions of heat change when we see it as a number.[96] Thermostats play a crucial role in the politics of air conditioning temperatures, particularly in shared spaces like offices and homes. People adjust to heat and cold "norms" through repeated exposure. In this, thermostats serve as "theory machines,"[97] leading people to develop models about how temperature should be regulated and for whom it is comfortable.

Social hierarchies also impact the regulation of temperature. In the mid-twentieth century, for instance, Black factory workers in the U.S. were often given the hottest, most dangerous jobs, due to the idea that they could "tolerate heat better".[98] Early advertisers of the thermostat stylized them as tools for maintaining family harmony, with claims that they could "keep Father calm" and reduce annoying behaviors caused by temperature changes.[99] These examples underscore the social hierarchies at play in setting temperatures.

Starosielski argues that thermostats can communicate "thermal violence," raising questions about who gets to choose the temperature. This issue has not gone without public attention: noting that indoor temperature norms are designed for the male body and are often too cold for most women, women's rights movements have emphasized that there is not a "one size fits all" approach.[100] Ultimately, the quest for a universally comfortable temperature is elusive, and individuals play an active role in creating their own thermal preferences.[101]

Acclimatization and Air Conditioning

Physiologically, bodies adapt (to a limited extent) to heat after repeated exposure. Initial responses to heat exposure include increased blood flow to the skin, promoting heat loss through radiation and convection, and increased sweat production for cooling through evaporation. Then, the body adapts by increasing plasma volume, slowing the heart rate, and dilating blood vessels. However, without periodic heat exposure, these adaptations can be lost.[102]

Physiological Acclimatization

- Increased blood flow to skin promotes heat loss through radiation and convection.
- Sweat production cools the body by evaporation.
- Heart rate increases to meet the body's need for increased blood flow.

But reliance on AC can undo this acclimatization. Studies show that regular AC users have less tolerance for outdoor heat. Eduardo Krüger and colleagues compared outdoor heat stress between individuals with access to air-conditioning at home and those without air conditioning in Rio de Janeiro.[103] The authors show that "a significant rise in the annual percentage of heat stress hours was found for AC-users," indicating that regular use of air conditioning can make individuals more susceptible to heat stress when exposed to outdoor conditions. In this way, AC reduces resilience by training the body to expect cool indoor climates.

The effects of heat acclimatization differ across time, space, and social groups. For instance, Daniel Vecellio and colleagues of the Heat Exchange and Thermal Energy Research Laboratory at Pennsylvania State University found that the first and second heatwaves of a warm season are associated with more hospitalizations than later ones, implying a protective effect of acclimatization.[104] They conclude that acclimatization, location, and age are the key variables for morbidity in a heat wave.

Geography also matters, but not always in the ways one might expect. For instance, people living in lower latitudes of the U.S. (associated with milder winter weather) are at greater risk of cold-related mortality, and people living in higher latitudes (associated with milder summer weather) are at greater risk to heat-related mortality.[105] A study that examined over 100 U.S. cities over 14 years found that excess mortality rates during heat waves to be higher in some northeastern and midwestern urban areas than in southern cities.[106]

Air-Conditioning Raises Outdoor Temperature

While air conditioning provides immediate relief from heat for certain individuals, it also contributes to outdoor heat. In Phoenix, for example, the use of air conditioning increases outdoor air temperature by more than 1.8° Fahrenheit (1° Celsius).[107] In Chongqing, China, reliance on air conditioning exacerbates urban heat island effects and air pollution, creating a feedback loop where increased cooling demands further degrade the urban climate.[108] It is estimated that air conditioning accounts for 4% of global greenhouse gas emissions, highlighting its environmental impact.

Cultural Contexts of Heat Policy

Most heat policy still emphasizes technical or infrastructural fixes rather than addressing the socio-political drivers of vulnerability and exposure.[109] While valuable, these approaches often leave out community-based and cultural strategies.[110] Policies based only on meteorological thresholds risk missing who is most exposed and how they actually live with heat.

Ladd Keith, the Director of the Heat Resilience Initiative at the University of Arizona, and colleagues identify four key barriers to better heat policy: 1) siloed policy and research; 2) complex, context-specific, and diverse contexts; 3) divisions between heat risk management and design of built environment strategies; and 4) the need for extensive, multidisciplinary data and tools.[111] These obstacles can all be traced back to cultural contexts.

If we acknowledge that people experience heat subjectively and unevenly, then a "one-size-fits-all" policy based solely on meteorological thresholds is bound to fall short. Public health and emergency response plans must integrate cultural knowledge and community input to properly target those most at risk and to design measures that local people will actually use and trust. Here we outline several other areas to consider.

Work Rhythms and Labor Systems

On a summer afternoon in Paris, a delivery rider pedals through traffic at 100°F (37.7°C). His insulated backpack and helmet hold in heat, but he steals moments of shade near fountains when orders allow. In Sindh, Pakistan, a brick kiln worker endures the same 100°F (37.7°C), compounded by the added blast of kiln fires. His day begins at dawn and stretches into midday, with breaks dictated by supervisors. The Paris rider has some autonomy, shaped by city infrastructure, while the kiln worker is bound to unrelenting labor.

Work patterns are a clear example of heat adaptation. In southern Europe and Latin America, siestas shift labor away from midday. In India, agricultural laborers often begin work before sunrise and stop before the peak heat. In parts of the U.S., roofers begin their work at dawn in the summer in order to finish before the hottest part of the day. These adaptations are not merely informal customs—they are often institutionally supported through local labor laws, public service schedules, and educational calendars.

These adaptations underscore what anthropologists have called "thermal pragmatism"—flexible scheduling based on bodily comfort and social norms rather than industrial-standard temporalities.[112] In Arabic, there are even two words for "season": *fasl* refers to astronomical seasons, while *mawsim* denotes flexible, community-defined cycles.[113] Across seasons, days, and hours, societies organize time in relation to the mode of production and physical environment.

However, in industrialized economies with standardized labor time and regulated productivity metrics, such temporal flexibility is often restricted, exacerbating heat-related risks, especially for outdoor and manual workers. Yet even within these systems, informal adaptations emerge: street vendors in Latin American cities often adjust routes or stall hours, while construction crews in places like Australia's monsoon region or Doha's urban concentrations adapt to local conditions.[114] These patterns reveal a tension between economic imperatives and thermal realities, suggesting that sustainable heat adaptation must not only involve technological or infrastructural fixes but also culturally-informed reconfigurations of time, labor, and rest.

Politics of Shade

Shade is another critical resource. It reduces exposure by 68–104°F (20–40°C) and can help protect vulnerable workers.[115] Yet shade distribution is often unequal, reflecting politics and planning priorities. The concept of shade as a cultural adaptation is gaining recognition, with some calling for shade to be considered an inalienable human right.[116] Journalist Sam Bloch characterizes shade as a civic resource, an index of inequality, and a requirement for public health.[117] In this way, we may see shade as a critical public health resource.[118]

In Karachi, Pakistan the loss of 40% of green space since 2001 has exacerbated heat stress, particularly for outdoor workers.[119] Here we see the thermodynamics of heat flow intersecting with the rhythms of labor, as workers manage thermal loads by finding reprieve on cooler streets, public parks, and under flyovers. Soha Macktoom and colleagues from the Karachi Urban Lab observe that "few people working in the outdoor spaces of the South Asian city today understand or experience shade [as a human right]." They argue that shade has become "something that must be claimed, alongside any other right or entitlement."[120]

Shade is an intuitive solution to heat.[121] Cities like Phoenix have recognized the importance of shade, implementing plans to increase tree canopy and target heat-vulnerable communities.[122] Phoenix, which regularly experiences almost 200 days above 89.6°F (32°C) was the first city to publish a Tree and Shade Master Plan in 2010, calling for a blanket 25% increase in tree canopy. Singapore requires plans for public spaces to show that at least 50% of the total area and seating are shaded at 9 a.m., 12 p.m., and 4 p.m. in midsummer. However, cultural values and politics can complicate the provision of shade. Writing of Los Angeles, Bloch notes that the perception of shade as a luxury rather than a public health issue can impact urban planning[123]. For instance, attitudes towards homeless individuals in Los Angeles are reflected in the idea that "public spaces need to be open, so that people can move across them, as opposed to gathering there."[124]

Planning for shade involves complex coordination across various government sectors and regulatory systems, necessitating a holistic approach to ensure shared goals.[125] One initiative that has had success in various cities is the provisioning of shaded bus stops. Based on a study of bus stops in Arizona, Yuliya Dzyuban found that shade reduced the average felt temperature by 66.2°F (19°C).[126] Aesthetically pleasing stops were rated as cooler than stops rated as less beautiful, meaning that heat perception is not only about temperature. They conclude that cities should prioritize shade and thermal comfort in public transit and urban planning to enhance public health and equity.

Culture Redistributes Heat: Hyderabad Report[127]

Infrastructural developments in Hyderabad, India, highlight the intersection of heat adaptation with social and economic inequalities. Here, infrastructural developments prioritize affluent areas, creating disparities in access to amenities like air-conditioned bus shelters.[128] Further, the privatization of water, as outlined in the Andhra Pradesh Water Policy (2008), treats water as an economic commodity, prioritizing elite consumption and profitability over equitable access.[129] This has led to a spatial segregation of water resources, where affluent communities enjoy 24/7 water supply, while poorer neighborhoods face irregular access and must often rely on costly informal water tanker services.

Perception and Communication

Perceptions also matter. In many places, heat is seen as something to be endured, not avoided, which can make warnings less effective. This perception significantly influences how heat events are communicated and managed. Brian Stone, Director of the Urban Climate Lab at Georgia Tech, calls for temperature to be reimagined for urban heat management, recognizing that (1) heat is invisible, (2) heat risk is not episodic, and (3) heat intensity is amplified by the layout of cities.[130]

Japan utilizes two types of heat alerts: the conventional Heat Stroke Alert and the Special Heat Stroke Alert, which is for severe heat conditions and covers 58 regions across Japan.[131] Both are based on predicted Wet Bulb Globe Temperature (WBGT) for a particular region. The *Heat Stroke Alert* is enacted when the WBGT index is predicted to be 91.4°F (33°C) or higher.[132] The Environment Ministry announces the alert at 5:00 p.m. the previous day and again at 5:00 a.m. the following day. People are advised to avoid going out as much as possible, keep rooms cool with air conditioning, avoid exercising as a general rule, and stay frequently hydrated. Special attention is given to vulnerable groups including older adults, children, people with chronic illnesses, obese people, and people with disabilities. The *Special Heat Stroke Alert* is issued when the WBGT index is expected to hit 95°F (35°C) or higher at all observation points within a prefecture. The Environment Ministry announces this alert around 2 p.m. the day before.[133] When a Special Heat Stroke Alert is in effect, affected prefectures must take thorough actions. Local governments are required to open designated "cooling shelters" in public and private facilities like community centers, libraries, and supermarkets. School principals, business managers, and event organizers must also implement comprehensive measures, such as canceling sports activities and outdoor events, and switching to remote work.

Heat alerts often rely on generic criteria (e.g., a forecast above a certain temperature or heat index). But what if a community doesn't perceive a given threshold as dangerous, or lacks the habit of listening to official weather reports? For instance, if local farm or construction workers are culturally conditioned to "push through" high heat as a badge of toughness, they might ignore heat advisories that could save their lives. In the U.S., there is indeed a pervasive cultural narrative – reinforced by idioms like "never let them see you sweat" – that equates endurance of heat with strength.[134] This narrative can be fatal in an era of intensifying heat waves.

Outreach must therefore be culturally resonant: messengers and messages should be tailored to different groups. In immigrant communities, that might mean using local languages and metaphors of heat, drawing on traditional proverbs about staying cool, or working through trusted community leaders rather than impersonal apps. It may also mean explicitly challenging harmful norms – for example, emphasizing that seeking shade and hydration in extreme heat is a smart survival strategy, not a sign of weakness. Public education campaigns can highlight historical examples of heat injury (such as past laborers or soldiers felled by heat) to combat the notion that "real men" or "tough people" don't need to heed the heat. In short, risk communication should align with cultural values and knowledge, not run counter to them.

Narratives as Heat Data in Phoenix

Narratives are essential tools in effective heat planning and policy, particularly in cities like Phoenix where the impacts of extreme heat are unevenly distributed. Research by Melissa Guardaro and colleagues demonstrates that personal stories and community narratives reveal dimensions of vulnerability and resilience overlooked by technical, top-down approaches.[135] While institutional actors tend to frame heat risk in terms of infrastructure and individual responsibility, residents' narratives highlight systemic issues such as housing precarity, racialized urban planning, and social isolation. Integrating these lived experiences into planning processes not only surfaces context-specific insights but also builds trust and fosters collaboration. Narrative-based approaches, as shown in the development of community heat action plans across Phoenix neighborhoods, enable more equitable and responsive policy by grounding interventions in the realities of those most affected.

Environmental scientists Anna Heidenreich and Annegret Thieken also highlight that "warnings should not only include the time and expected temperature of the heat waves but should also be accompanied by adaptation information and recommended actions."[136]

In the United States, there is a growing call for the Federal Emergency Management Agency (FEMA) to recognize extreme heat as a disaster, which would enable access to federal funds for heat-related emergencies and align FEMA's response to heat with its response to other natural disasters. This recognition could unlock significant funding for communities to implement cooling measures, such as air conditioning in public cooling centers.[137] Such efforts are hindered by the Stafford Act, which funds FEMA and whose emphasis on infrastructure impacts sets a high bar for emergency responses to heat. The Arsht-Rockefeller Resilience Center has proposed naming heat waves to underscore their public health significance and enhance risk communication, a strategy supported by Eric Klinenberg, who calls heat waves a "killer climate disaster that has no name."[138]

However, naming heat waves or sending out heat alerts are meaningless without addressing inequity. In her study of Buffalo, New York, Zoe Hamstead found that residents were well aware of effects on heat on their health and mental wellbeing. She notes that by and large people are highly attuned to weather that is health-threatening.[139] Thus, she concludes, "heat inequity may be more a function of who has agency over adaptive practices, particularly in occupational settings controlled by an employer or residential settings in which a renter cannot control their energy system or energy efficiency infrastructure. These power relations suggest a need to strengthen thermal protection regulations against those who do have agency in such settings."[140]

It is vital that policymakers use frameworks that address socioeconomic divides, such as the social-ecological model that sees the individual as part of other interpersonal relationships, community and institutional structures, and the wider society. The three spheres framework of heat risk behavior introduced by Niall McLoughlin and colleagues is a similar nested model that provides a comprehensive approach to understanding and addressing heat risks.[141] This framework includes a central "behavioral" sphere which includes actions that individuals can take in response to heat risks, but emphasizes that these individual actions are encapsulated by two layers of "antecedents" – or things that impact behaviors. The middle "individual" sphere includes personal, affective, and cognitive antecedents of heat risk behavior, including values, ideologies, awareness, and experience. The outer "contextual" sphere covers sociocultural, economic, and political factors such as policy, geography, and demographics.

"Adaptation" at Multiple Scales, Different Meanings

"Adaptation" is a common term in climate and health policy, but it means different things in different contexts. Many so-called adaptations—like air conditioning—are less about adjusting to heat and more about avoiding it through technology. Beliefs and assumptions also shape who is expected to adapt and what forms adaptation should take. For example, the belief that some races are inherently better suited to hot conditions can obscure who is truly vulnerable.

Crucially, we distinguish between cultural adaptations and racialized assumptions. Cultural adaptations—such as siestas, shaded architecture, or clothing choices—are learned practices developed in specific environments. By contrast, claims of inherent racial differences in heat tolerance are scientifically unfounded and historically tied to racist ideologies that naturalized inequality. What varies is not biology by race, but exposure, resources, and cultural practices.

Culture, Not Biology

Communities around the world adapt to heat through culture: work rhythms, architecture, clothing, and social norms. These are learned practices, not innate traits. Historical claims that certain races are biologically more "tolerant" of heat are unfounded and have been used to justify unequal treatment in labor and housing. Recognizing heat adaptations as cultural, not biological, helps ensure that policy draws on community strengths without reinforcing stereotypes.

A more useful perspective sees adaptation as happening at multiple scales—from changes in the human body, to local communities, to global energy systems. In the mid-twentieth century, the prevailing view in anthropology was that culture was an "extra-somatic" means of adaptation. In other words, culture involved social adaptations that were not biologically determined. By the late twentieth century, scholars rejected this view as too narrow, emphasizing the complex and dynamic relationship between biology and culture. This "biocultural" approach further emphasized that we must understand human adaptation in relation to much larger systems, such as global markets, infrastructure, and politics.

Electric grids, labor laws, zoning codes, and building standards are all cultural systems that reflect values and assumptions about how people should live with climate. For example, the historical practice of redlining in the U.S.—where resources such as mortgages or healthcare services were withheld from certain racial and ethnic neighborhoods—is a material manifestation of racism that continues to shape which communities bear the brunt of heat today. **This shows why adaptation strategies must be designed with history and inequality in mind.**

This also means adaptation is never just biological—it is also political and cultural. Culture is not merely "what others do." It includes the values and assumptions embedded in technologies, institutions, and policies. Recognizing this can help build more just, inclusive, and effective responses to rising heat. As we have shown, air conditioning and the politics of temperature in collective spaces illustrate how cultures adapt not only to the natural environment but also to ideas and structures around economic growth, individual autonomy, and market-based solutions. This broader understanding of adaptation emphasizes the role of culture in shaping built environments and policies.

The 2024 Lancet Countdown on Health and Climate Change identifies six key limits to adaptation.[142] These include physiological, financial, and infrastructural limits. But they also include knowledge ("human limits to understanding the interaction between the natural world and health outcomes") and social, cultural, and behavioral limits ("people's capacity or willingness to adopt protective behavioral changes is often limited by their habits, culture, beliefs, or social networks").

These limits remind us that adaptation is complex, and effective strategies must respect cultural differences in how people understand and respond to heat.

> **"In the U.S., there is indeed a pervasive cultural narrative – reinforced by idioms like "never let them see you sweat" – that equates endurance of heat with strength. This narrative can be fatal in an era of intensifying heat waves."**


RESTAURANT
SCHOOL

Cultural Contexts Can Provide Solutions

The evidence presented in this brief leads to a clear conclusion: addressing the health impacts of extreme heat requires more than infrastructure upgrades and climate models. It demands a shift in how we understand vulnerability, adaptation, and resilience—starting with a recognition that culture is not peripheral but central to heat management. Cultural values, habits, infrastructures, and histories shape how people experience heat, respond to it, and organize collective care.

Culture determines not only how people define "too hot," but also who bears the burden of the resources and actions needed to stay cool. It informs decisions about clothing, work rhythms, home design, bodily norms, and institutional expectations. While much policy focuses on expanding access to air conditioning or deploying meteorological alerts, these solutions remain incomplete without attention to the cultural systems that define heat and shape exposure.

Cultural practices are not just barriers to overcome—they are sources of solutions. Around the world, communities have long managed heat with shaded courtyards, rooftop sleeping, siestas, adaptive clothing, and collective rhythms of rest. These are not simply traditions; they are technologies of resilience. Supporting and scaling such solutions requires validating them as legitimate public health interventions, embedding them in policy frameworks, and protecting them from displacement or erasure through modernization.

To do this, policymakers need to move beyond relying only on centralized messaging and technical fixes and instead work with cultural actors and communities. That includes designers, educators, faith leaders, elders, youth groups, and mutual aid networks. It also means funding co-created interventions, using participatory methods, and recognizing that trust and meaning are as essential to resilience as temperature thresholds or building codes.

In short, culture is a form of infrastructure. It may be less visible than cooling centers or green roofs, but it is just as consequential in shaping risk and recovery. As climate change accelerates, the challenge is not only to build physical defenses but to strengthen cultural systems that promote care, equity, and adaptation. Putting culture at the center of heat-health planning leads to policies that are not only more effective but also more just and lasting.

Key Findings and Recommendations

If heat-related vulnerability is socially-produced, then it can—and must—be culturally, institutionally, and politically mitigated. This foundational argument reframes heat not as a natural or purely external environmental force, but as a syndemic issue shaped by historical, social, and infrastructural processes. This perspective has implications for how we understand vulnerability, organize knowledge, and imagine policy responses. From this core premise, three interlinked conclusions emerge, each tied to specific lines of reasoning and concrete recommendations:

1. Look Local: Heat Vulnerability Is Uneven and Context-Dependent

Heat-related vulnerability is not equally distributed—it varies by place, population, and context. While this inequity is widely recognized in existing literature, this report emphasizes that these differences are often poorly understood due to an overreliance on geospatial and quantitative analyses involving standardized metrics and data models. These obscure the diverse, place-based mechanisms through which vulnerability operates. Consequently, heat mitigation strategies based on universal temperature standards often marginalize already vulnerable populations.

We need to look at the lived experience of heat in particular contexts and learn from local innovations. Cultural adaptations to heat are multifaceted and deeply rooted in local practices and social norms. These adaptations offer practical solutions for managing heat. This report offers examples of locally adapted ideas–architecture, shade, food, clothing, temporality–but many of these have been replaced by air conditioning and other environmental control technologies. However, as climate change continues to exacerbate heat extremes, understanding and leveraging these cultural adaptations will be crucial for building resilient communities.

"Looking local" shines a spotlight on social justice in heat policy. Heat does not impact all people equally, and those disparities often follow lines of ethnicity, race, and class. For example, outdoor workers and those in physically demanding jobs – disproportionately lower-income and often from minority groups – face the brunt of extreme heat exposure. Yet, workplace protections in many countries are weak.

In the U.S., only a handful of states (such as California and Minnesota) have enforceable heat standards for outdoor laborers, while most states and the federal government have none.[143] The absence of robust workplace heat rules reflects a cultural undervaluing of the lives of farmworkers, construction crews, delivery personnel, and others who have to endure heat as part of their jobs. Additionally, a gap persists between labor laws for outdoor laborers and those who labor in indoor environments that can become hotter during extreme heat, such as warehouses.

Historically, this traces back to an ugly truth: during slavery and Jim Crow, and continuing through migrant farm labor today, society has expected Black and brown bodies to toil in sweltering fields while more privileged groups were shielded from the sun. The legacy of viewing heat hardships as a burden for the marginalized (and a trivial inconvenience for the well-off) persists in the lack of comprehensive policies. Correcting this requires intentional focus on those communities' experiences.

In order to do this, heat policy needs to integrate community engagement, grassroots resilience strategies, and lived experience into program design and implementation. Policymakers should engage with worker advocacy groups, indigenous nations, and neighborhood associations to learn where current metrics and interventions are missing the mark. These groups can offer insight into "invisible" heat problems, such as dangerously hot factory floors or the inability of older adult tenants to afford running an air conditioner.

For instance, community-driven heat mapping projects – in which residents use sensors or report their daily thermal discomfort – have already been implemented in cities like New York and Los Angeles to identify hotspots that official maps overlooked. Such participatory science validates local thermal perceptions and helps target resources (for example, pinpointing which apartment buildings need emergency cooling kits or which outdoor work sites should mandate extra breaks).

Qualitative research and conversational engagement at the grassroots level is equally as important to understand cultural preferences. For instance, some people may avoid cooling centers due to a reluctance to mix with the opposite gender in certain cultures, or a distrust of government-run facilities in communities with historical reasons for wariness. In such cases, alternatives informed by community input could be crucial to forming innovative ideas, such as setting up cooling areas in faith-based centers, or organizing women-only cooling hours, or deploying mobile cooling buses that visit high-risk areas.

Policymakers should also draw on cultural resilience strategies from around the world.

Many traditional practices for coping with heat can be part of modern resilience plans. Siesta hours (afternoon rest) have long been common in Mediterranean and Latin American cultures to avoid the worst of the midday heat – today, some U.S. and Australian cities are considering similar adjustments to work hours during heatwaves. Likewise, cooling techniques like the use of wet compresses, foot baths, or herbal drinks (e.g., prickly pear juice in North Africa, or chrysanthemum tea in China) could be promoted in public health advisories as low-cost ways to stay safe. Engaging with community healers, Indigenous knowledge-keepers, or cultural organizations might surface these time-tested methods.

Similarly, shifting work hours to avoid the hottest parts of the day, as seen in historical and anthropological examples, can be an effective strategy. Chin Leong Lim reports that increasing heat will likely lead to a shift towards a sub-nocturnal lifestyle (active during the days but up later into the night): "To avoid the heat from the sun, outdoor activities would likely begin closer to, or soon after sunset, and could extend to the next morning before dawn, or soon after sunrise. This projected shift towards a sub-nocturnal lifestyle could be associated with the limbic system, which drives human behavior to operate in a 'comfort zone'."[144]

Traditional architecture and urban design also offer clues for intervention. Many vernacular building styles in hot climates evolved to maximize airflow and shade (think of courtyard houses, thick adobe walls, painted white roofs). Reviving or subsidizing these architectural cooling techniques – even in places where they did not originate – can complement high-tech solutions. In some regions, reintroducing green infrastructure sacred to local culture – like groves or community ponds – can also provide both spiritual fulfillment and heat relief (via evapotranspiration and shade). Collaborating with cultural practitioners (such as traditional Indian architectural experts, Vastu, who manage wind and heat flow in dwellings) might yield creative, community-owned approaches to mitigating heat at the neighborhood scale.

Of course, urban design initiatives should occur at multiple scales: landscape, urban, community, building, and individual.[145] Landscape-level interventions include increasing blue and green spaces, while building strategies include improving construction materials and enhancing ventilation. The 2024 Lancet Countdown emphasizes that expanding equitable access to green spaces can mitigate heat-related health impacts while offering co-benefits for physical and mental health.[146] Yet, between 2015 and 2023, the proportion of urban centers with at least moderate levels of greenness remained stagnant at 28%. In buildings, integrating solutions that cool the person rather than the environment—such as fans, self-dousing, foot immersion, misting fans, ice towels, and temperature-adapted clothing— are also helpful.[147]

Cities across the world are already integrating local approaches to heat management. Marie Josefine Hintz and colleagues found that the city administration is a pivotal actor in heat mitigation, underlining the role of local responses.[148] While local responses are complex and costly, as David Hondula, Phoenix's Chief Heat Officer acknowledges,[149] building a city that's resilient to heat can also become a part of a local culture. Many cities are already engaged in projects that help create a heat resilient culture. Hamburg, as part of the Clever City Project, promotes community-driven greening projects to combat urban heating. Incorporating schools, businesses, and private citizens, the project has created a green corridor, green roofs, and school garden.[150] Lisbon has implemented participatory planning processes that involve citizens in urban design and climate adaptation. Community engagement in developing shading structures and selecting materials for public spaces reflects a bottom-up approach to thermal comfort. In Singapore, rooftop gardens and vertical greenery have significantly reduced the energy demand for air-conditioning by cooling the ambient air surrounding buildings. One study found that such gardens could reduce roof surface temperatures by over 86°F (30°C), lowering energy use by up to 70%.[151]

Informal strategies continue even without official city efforts. In Santiago de Chile's informal settlements, for instance, residents frequently modify their homes using materials like plastic sheeting to improve insulation, reflecting a form of thermal governance rooted in necessity and improvisation. City governments can learn from such bottom-up adaptations, which highlight the limitations of one-size-fits-all standards and the importance of context-specific approaches that acknowledge the ingenuity of residents in managing their thermal environments.[152]

Recommendations:

Rather than imposing a top-down solution, an equitable heat-health policy empowers communities to implement solutions that make sense locally—with government support from U.S. federal agencies in the form of funding, infrastructure, or scientific validation as needed. To address this, the report calls for a "look local" approach—drawing on ethnographic, historical, and qualitative research to understand how vulnerability manifests locally. This entails engaging communities as knowledge partners, integrating lived experience into planning processes, and using co-design to craft metrics and interventions that reflect real, context-specific needs.

1. **Recognize and support local traditions to work with culture, not against it.** This means acknowledging community responses and thermal knowledge embedded in local practices, such as architecture, work rhythms, dress, and diet.
2. **Integrate anthropologists, sociologists, community-based organizations, and local knowledge into heat science and health policy.**
3. **Enact policies for heat-sensitive work schedules,** especially for outdoor and informal laborers.

2. Look Around: Knowledge and Institutions Are Siloed

Despite growing interest in the heat-health nexus, our knowledge remains fragmented. Expertise is siloed across disciplines and institutions, leading to a partial and often technical understanding of the problem. The tendency to define heat in terms of universal metrics (like temperature thresholds or heat indices) promotes a narrow focus on infrastructural fixes (e.g., white roofs, cooling centers), often at the expense of more integrated, systemic solutions.

This siloing is not neutral—it shapes whose voices are heard in policy processes, with technoscientific understandings of heat getting more airtime than the lived experience of vulnerable populations. However, when solutions tend to prioritize technical solutions and physical infrastructure over social context, the responsibility for heat becomes dispersed among institutions that are often ill-equipped to respond to communities locally and holistically.

Since heat policy often falls between knowledge and policy silos, it is difficult to address the cross-cutting nature of heat-related health issues effectively. Agencies like the Occupational Safety and Health Administration (OSHA), Centers for Disease Control and Prevention (CDC), and the Environmental Protection Agency (EPA) must operate within their specific mandates, which can hinder comprehensive heat management strategies. Local solutions, such as the establishment of heat offices in cities like Phoenix, may work better to overcome these silos and implement integrative approaches.

This is especially important because heat inequity often stems from a lack of agency over adaptive practices, especially in occupational settings or residential environments where individuals cannot control their energy systems.[153] To address this, we must strengthen thermal protection regulations and ensure that vulnerable populations have access to adaptive resources at the local level. We also need more qualitative data on adaptation to understand the lived experiences of residents.

An integrative approach to heat management must consider the interplay of environmental, social, political, and economic factors. This includes recognizing the role of culture in shaping policy, and is echoed in the 2024 Lancet Countdown on Health and Climate Change, which emphasizes the need for comprehensive strategies that go beyond technological fixes.[154]

Taking a syndemic approach to heat helps policy makers recognize that heat-related health impacts arise from the interaction of environmental stressors and physiological vulnerabilities with social, economic, and cultural contexts.

Recommendations:

To overcome silos, the report recommends a "look around" strategy—building cross-sectoral and interdisciplinary coalitions, fostering institutional integration, and rethinking what counts as legitimate knowledge. This involves breaking down barriers between urban planning, public health, labor, environmental science, and the social sciences. It also requires new forms of data and evaluation that foreground visibility, social inequity, and non-technological responses to heat.

1. **Bridge siloed research and policy domains** by recognizing heat as a syndemic issue and thinking holistically. Develop strategies that link heat adaptation to areas like housing, chronic disease, social isolation, mobility, and infrastructure.
2. **Redesign universal thermal metrics and standards** to better reflect lived experience by complementing metrics with qualitative data on perception, behavior, and vulnerability, and reflecting diverse body types, cultural expectations, and regional variations.
3. **Reframe adaptation beyond technology.** Avoid over-reliance on technological solutions such as air conditioning, which can exacerbate inequality and environmental degradation. Air conditioning will remain an important tool in emergencies, but it cannot be the cornerstone of heat policy. Framing AC as "the answer" obscures more sustainable, culturally grounded strategies and risks locking societies into unsustainable paths.

3. Look Up: Dominant Cultures of Heat and Comfort Must Be Reimagined

Our final conclusion invites a deeper reflection: the thermal environments we live in are themselves culturally constructed. This includes not only how communities in different parts of the world cope with heat, but also the assumptions embedded in science, policy, engineering, and architecture. The dominance of air conditioning, for instance, reflects a particular cultural view—one that values comfort, control, and enclosure, often at the expense of energy equity and sustainability. Broadening our understanding of heat to include cultural perspectives may inspire innovative policy frameworks.

One approach (started in Seville, Spain) is to give heat waves names and numerical rankings, as we do with hurricanes. This idea stems in part from the recognition that heat's impacts, though statistically deadlier than many disasters, often fail to prompt the same cultural responses because they lack the visceral imagery and narrative of storms. By personifying or dramatizing extreme heat events (e.g., "Heatwave Zoe" rated Category 3), authorities hope to overcome the public's perceptual bias that tends to shrug off heat.

Another emerging concept is "thermal equity audits" for cities – assessing not just where temperatures are highest, but where people are most socially vulnerable to heat, and investigating cultural reasons why certain groups remain unprotected. Such audits, combined with storytelling initiatives that allow residents to share what extreme heat feels like in their community, can re-center policy on human experience. In practice, this could mean everything from heat-awareness training in multiple languages, to revising building codes to account for cultural patterns of building use, to including indigenous land managers in climate adaptation planning.

Reframing heat as not just a meteorological phenomenon but also a cultural and social experience opens up new pathways for intervention. It urges us to move beyond the tyranny of the thermometer and design heat-health policies that acknowledge how people actually live, feel, and make meaning in hot conditions. By appreciating cultural knowledge of heat—whether it's Maya healers measuring balance, Hawaiian elders reading the mountain breezes, or urban neighborhoods mapping their own heat exposure—we gain tools to craft responses that people find relevant and fair. Ultimately, embracing these understandings of heat can lead to more targeted warnings, more accessible cooling strategies, and a more human-centered approach to managing heat risks. In a warming world, we cannot afford to ignore how different cultures have weathered the heat. Integrating that wisdom with scientific insight will help ensure our heat-health interventions are not only technically sound but also socially inclusive, effective, and just.

Recommendations:

This is a call to "look up"—to critically examine and deconstruct our own thermal cultures but also to speak out. It means acknowledging that existing heat mitigation strategies are embedded in cultural assumptions about normalcy, productivity, and value. Social science and historical research can illuminate alternative models from other times and places—vernacular architectures, communal cooling practices, and seasonal work rhythms—that challenge dominant techno-centric approaches. The report urges policymakers to support a reimagination of thermal norms: rethinking taken-for-granted norms around sweat, rest, flexible labor schedules, and shared solutions. Reimagining thermal cultures expands the range of possible futures and health outcomes, moving from reactive and often maladaptive technical fixes toward collective and culturally grounded resilience.

1. **Go beyond recognition to collaboration,** engaging social scientists and community organizations, identifying priorities, and co-designing with (not for) communities. Community-based adaptive strategies include investing in shade infrastructure, passive cooling design, and retrofits that incorporate traditional design features (like wind catchers or courtyards).
2. **Shift from individualized solutions to collective, culturally grounded responses,** including re-norming around temperature comfort levels.
3. **Employ culturally resonant communication** to challenge cultural narratives that encourage people to endure heat, and to provide practical guidance on what to do. Recognize heat events as natural disasters, making them more visible and freeing funds for response.

Together, these three moves—looking down, looking around, and looking up—offer a transformative framework for responding to extreme heat. They shift the focus from managing symptoms to interrogating root causes; from siloed solutions to systemic thinking; from technical fixes to cultural re-norming. Crucially, this approach repositions culture not as an obstacle to implementation, but as a form of infrastructure—a generative space of knowledge, adaptation, and possibility. By embracing this culturally-informed perspective, policymakers and practitioners can develop heat-health strategies that are not only more effective, but more just, inclusive, and resilient.

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