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In the Hot Seat: Saving Lives from Extreme Heat in Washington State

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IN THE HOT SEAT: SAVING LIVES FROM EXTREME HEAT IN WASHINGTON STATE

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 **OWSC**


GONZAGA
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Center for Climate, Society,
and the Environment

1. Sustaining action on extreme heat

Between June 26 and July 2, 2021, an extreme heat event caused by a “heat dome” descended upon the Pacific Northwest, setting 128 all-time high temperature records across Washington state[1] and killing 126 Washingtonians due to heat-related causes according to official estimates. [2] However, the true health impact was considerably larger: 441 more people died between June 27 and July 3 than would have been expected based on prior years, after removing deaths from COVID-19.[3] “Excess deaths” captures deaths where heat played an indirect role, such as kidney failure or cardiac arrest. The 2021 heat dome was the deadliest weather-related disaster in Washington state history.[4] In addition to the lives lost, a far greater number of people suffered from heat-related illnesses, and the event caused significant economic damage.[5][6] The tale of suffering from this single event is a call to action, especially as Washington is projected to experience increasingly frequent and severe extreme heat events in the future.

Our shared public health objective is to reduce the health impacts of heat exposure and save lives from extreme heat, especially by focusing on the most vulnerable Washingtonians.

Heat-related illnesses and deaths are largely preventable. So why did so many Washingtonians suffer and die in the 2021 heat dome event, and how could we do better during future extreme heat events? Those questions motivated this

report. Enough is already known about the risks of extreme heat, and potential solutions, to take immediate action that will save the lives of Washingtonians when the next extreme heat event occurs. At the same time, we acknowledge that pressing policy problems, persistent coordination challenges and limited resources complicate efforts to take action. With this in mind, we call for sustained action where individuals, communities, and local and state governments commit to mitigating extreme heat as an ongoing part of their work. Our shared public health objective is to reduce the health impacts of heat exposure and save lives from extreme heat, especially by focusing on the most vulnerable Washingtonians.

EQUITY IN THE SPOTLIGHT: A MORE HOLISTIC VIEW OF HEALTH

This report relies on a conventional Western conception of individual physiological health. Nonetheless, other conceptions of community health should inform strategies used to prevent harms from extreme heat events. These conceptions of health and well-being may include non-physiological aspects of health important to a community. For example, the Swinomish Indian Tribal Community, a Coast Salish Nation, views health as inclusive of the “physical, social, mental and cultural realms on individual, familial and community scales, including reciprocal relations between people, their natural environment, and nonhuman beings.”[7] By adopting a more comprehensive perspective on health, this call to action on extreme heat becomes more compelling. Extreme heat impacts not only our physical health, but our social and mental health as well. Extreme heat also has significant effects in ecological systems and on relationships between humans and non-human beings.



In the spirit of ‘knowing enough to take action,’ this report only briefly describes the nature of the problem (see Section 2). We devote most of the report to discussing specific strategies that can be taken by individuals, communities and all levels of government to improve public health outcomes (see Section 3). We then highlight three tools and approaches that provide additional information on how to maximize impact (see Section 4). We conclude with 4 key take-away points and 5 recommendations.

2. Out of the frying pan, into the fire

What are the impacts of extreme heat?

Exposure to extreme heat can stress multiple organ systems and put people at risk for illness and death. Heat-related illness is an umbrella term that includes

acute heat illnesses (e.g., heat exhaustion, heat stroke), chronic disease exacerbations (e.g., flares of cardiovascular, kidney, respiratory and psychiatric disorders), injuries (e.g., occupational injuries, drowning), and adverse pregnancy outcomes (e.g., premature delivery, low-birth weight).[8] The volume of heat-related illnesses during an extreme heat event can strain the health system — increasing 911 calls, ambulance transports, emergency department visits and hospital admissions — and can ultimately be lethal. [9] Socioeconomic impacts of extreme heat in the United States include increased illness and death, resulting in healthcare costs, productivity losses and more. The United States stands to lose on average \$100 billion annually from lost labor productivity alone, which is roughly set to double by 2030 and quintuple by 2050 without mitigation.[10]

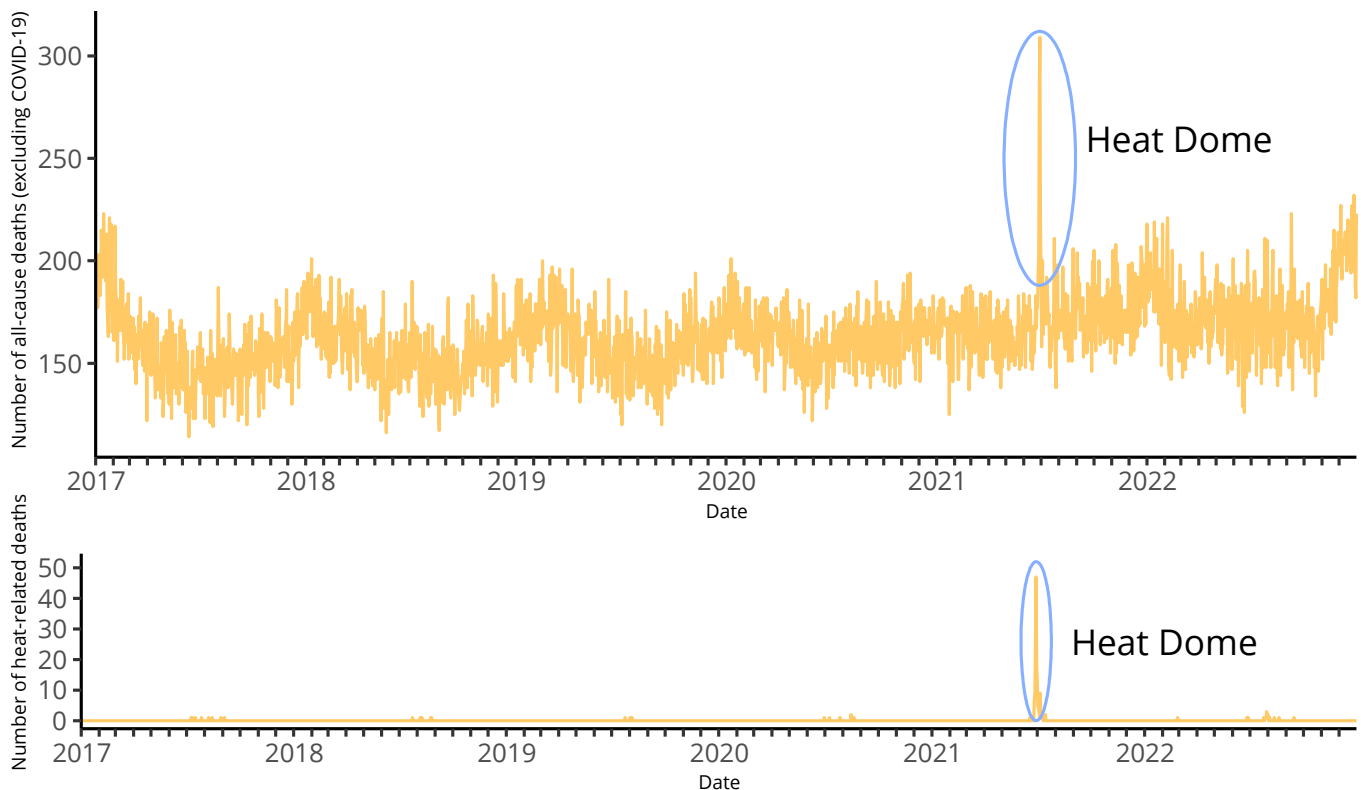


Figure 1: Daily all-cause deaths excluding COVID-19 (top) and daily heat-related deaths (bottom) in Washington state from January 1, 2017 to December 31, 2022. The highest number of all-cause deaths in the time period occurred on June 28 and June 29, 2021, with almost double the daily average number of 163 deaths/day from 2017 to 2020 (top). There were eight or fewer heat-related deaths reported each year from 2017 to 2021 (bottom). During the heat dome period there was an average of 18 heat-related deaths per day. These figures are based on the date of death recorded in the Data Quality and Statistical Services database at the Washington State Department of Health. Note: 2022 data are preliminary.[2]

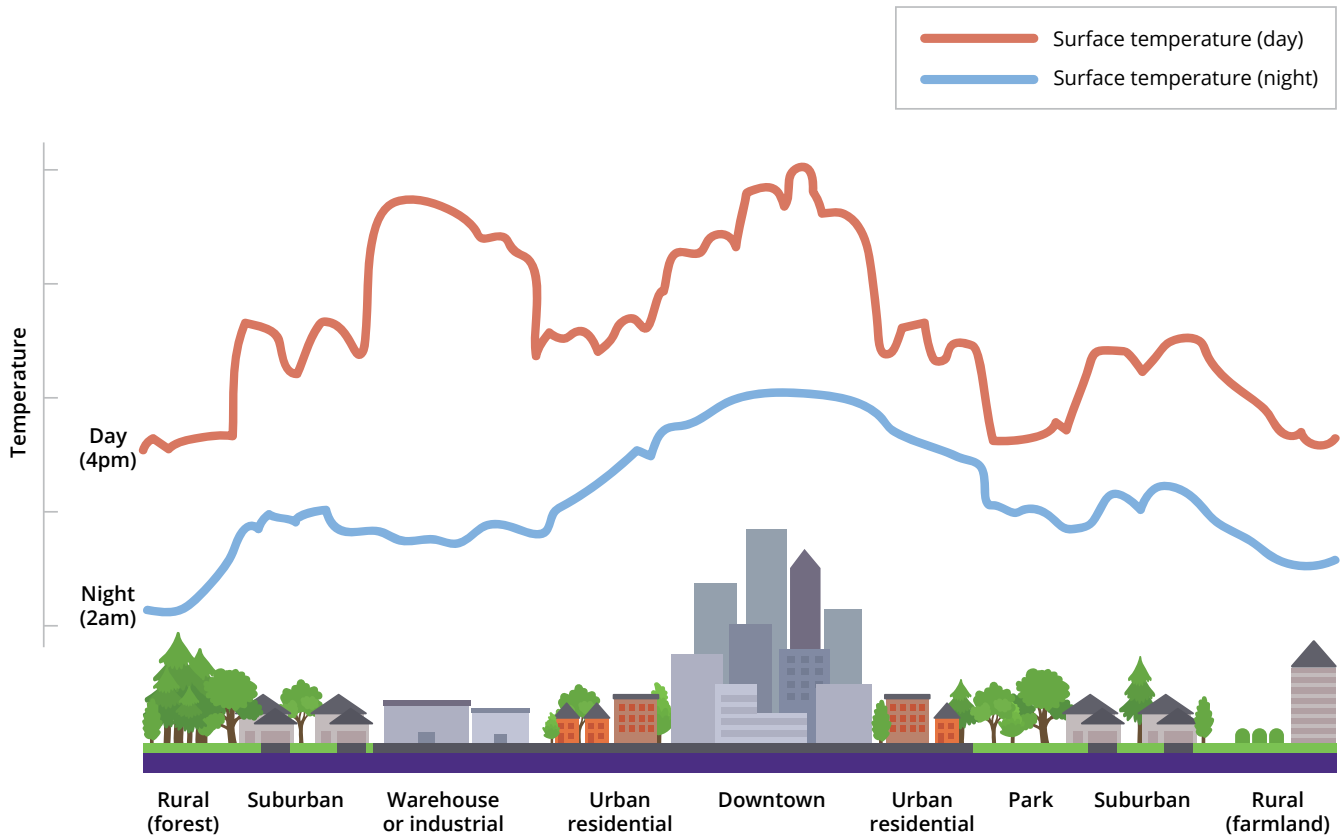


Figure 2: Day and night surface temperatures in a hypothetical urban heat island (adapted from U.S. EPA) Urban development such as buildings and roads absorb and re-emit solar heat more than natural landscapes such as forests, parks and rural areas. Heat builds up where development is highly concentrated and tree canopy is limited, and can increase heat-related stress on the human body.

EQUITY IN THE SPOTLIGHT: THE MOST VULNERABLE AMONG US

As a result of the underlying sociological, economic and policy drivers that perpetuate inequalities, low-income households and communities of color are disproportionately exposed to higher levels of pollution. [16] This contributes to higher rates of heat-related risk factors such as elevated rates of cardiovascular disease, hypertension, and respiratory illness.[17][18] This is one legacy of the racist and exclusionary tactics in real estate and housing, such as redlining.[19] Formerly redlined neighborhoods also have less tree canopy and more impervious land cover than surrounding areas, causing these areas to be relatively hotter.[20]

How is risk changing in the future?

Unfortunately, demographic projections alone suggest greater vulnerability to extreme heat in the future. While 16.7% of Washington state's population was 65 and older in 2020, that number is projected to grow to 21.7% by 2040 — exceeding 2 million vulnerable older Washingtonians. [21] The prevalence of asthma and respiratory disease, which are significant risk factors during extreme heat events,[22] has also been increasing. In 2020, an estimated 15% of adults in Washington reported being diagnosed with asthma, up from about 12% of the adult population two decades prior.[23] Further, development and population growth trends over the last decade have been concentrated in the five largest metropolitan counties, expanding urban heat islands and increasing the population that is potentially vulnerable to extreme heat.

As the climate warms, extreme heat events are occurring more frequently across the globe, a trend we expect to emerge in Washington state too.

Temperatures will become hotter and extreme heat events will become more frequent in Washington state in the coming years. Climate model projections indicate summer temperatures in the Pacific Northwest in the 2050s warming by about 4 to 6°F relative to the last half of the 20th century.³ As the climate warms, extreme heat events are occurring more frequently across the globe,[25] a trend we expect to emerge in Washington state too. Between 1971 and 2021, Washington experienced an average of three extreme heat days per year.⁴ By the 2050s, there will be between 17 and 27 extreme heat days on average for western Washington and between 20 and 30 for eastern Washington. By the 2080s, the upper end of that range nearly doubles with an average of 20 to 48 extreme heat days for western Washington and 23 to 47 days for eastern Washington (see Figure 3).⁵

Extreme heat is deadly, can overwhelm our hospitals and emergency medical systems, and can cause economic damages. There is good reason to believe that Washington residents will be at increased risk of illness and death from heat going forward. So while we are out of the frying pan of the 2021 heat dome, we are not yet out of the fire. Reducing extreme heat health risks should be a top priority for Washington state.

3. Your vital contribution can save lives

This report raises awareness, particularly for the many people and institutions with no public health mandate that may not realize the small but vital contribution each can make to save lives from extreme heat. Reducing vulnerability is key. Evidence from places with hotter climates than Washington's makes it clear that people can survive and thrive in areas with high heat exposure. Reducing vulnerability is not simply a matter of improving emergency response. Saving lives requires us to focus both on short-term emergency response (e.g., extreme weather warning systems, staging medical supplies and personnel and operating cooling centers), but also on long-term risk reduction (e.g., occupational heat safety rules; building health care surge capacity; and reducing urban heat islands through planting trees, building green roofs and removing impervious surfaces).

³ These projections are based on SSP 2-4.5 ensemble model averages. The models indicate 4.2 to 4.8°F of summer warming west of the Cascades and 5.0 to 6.2°F east of the Cascades.[24]

⁴ Historical extreme heat days are defined as those that exceed the 99th percentile temperature threshold for a subset of weather stations located in western Washington and eastern Washington, separately, loosely following the methodology in Bumbaco et al. 2013.[26]

⁵ The ranges of the number of future extreme heat days are the medians of 10 MACA downscaled CMIP5 climate models, using two different emissions scenarios, RCP4.5 and RCP8.5. The 2050s is the median of model outputs for 2040-2069 and the 2080s is the median of 2070-2099. The range among the extreme heat days is wider for 2085 due to the divergence of the two emissions scenarios.

The following nine strategy summaries present examples of specific actions to reduce extreme heat health risks and save lives. There are no universal or one-size-fits-all solutions, and approaches to these decisions may differ based on participants and political contexts. Icons act as visual signposts by symbolizing which participants may be involved in the implementation of each strategy (see Figure 5).



Figure 5: Participant icons for strategy implementation



B. Enhance heat warning systems with community outreach

Emergency advisories using multiple channels, such as mass notification systems and broadcast media such as TV, radio and newspapers have increased awareness of extreme heat health risks. However, perception of personal risk and the ability of advisories to meaningfully change behavior remains low, especially among the most vulnerable communities.[29] A 2007 survey of residents in Phoenix found that despite awareness of a heat advisory, less than half of persons over 65, a particularly vulnerable group, modified their behavior.[30] Harnessing familial, community and peer relationships could reinforce health safety action — especially among individuals who distrust government — and potentially reduce strain on emergency medical responders during heat events.[29][31]

Example: Be a Buddy NYC

Be a Buddy NYC is a New York City program that provides community organizations resources to “communicate protective health messages to hard-to-reach populations via trusted messengers.”[32] The interagency partnership that includes the NYC Department of Health and Mental Hygiene and the Mayor’s Office of Resiliency matches neighborhood volunteers who conduct telephone and, if necessary, door-to-door and building level wellness checks on vulnerable individuals during severe weather events.[33] Learn more about Be a Buddy NYC: <https://climate.cityofnewyork.us/initiatives/be-a-buddy/>



FUNDING IDEA: STATE-FUNDED COMMUNITY ACTION GRANTS

While NYC and similar cities have funded community grants and program awards out of their municipal general fund budgets, states can also play a crucial role. For example, the State of Maine provides grants of up to \$50,000 through the Governor’s Office of Policy Innovation and the Future to support peer-to-peer programs for conducting wellness checks on vulnerable community members during extreme temperatures. Learn more about Maine’s Community Action Grants: <https://www.maine.gov/future/climate/community-resilience-partnership/grants>



C. Create culturally specific cooling centers/resilience hubs

Cooling centers are typically facilities with AC such as libraries, community and senior centers, churches, schools, and malls where vulnerable persons can seek shelter if they are unhoused, do not have household AC units or are hesitant to use AC because of electricity costs. [34] The effectiveness of a cooling center — which may be part of a broader resilience hub designed to provide ongoing community services and support residents across multiple natural hazard event types — relies on accessibility, perception and awareness of the resource. In some communities, cooling centers are underutilized by the populations they are meant to serve because of misperceptions of risk, government mistrust or other tangible and intangible barriers. A survey in one major U.S. city found respondents did not perceive themselves as vulnerable, did not want to be surrounded by “old people,” or feared leaving their home unoccupied for long periods of time.[35] Culturally specific resources led by community-based organizations can help work around issues of government distrust and tailor services to the local preferences of vulnerable populations. Economic returns from resilience hubs are numerous, including but not limited to returns from public health and safety, economic stability, community energy cost savings, social equity, environmental sustainability and community cohesion.[36]



FUNDING IDEA: COMMUNITY COOLING CENTER GRANTS

In 2021, the Oregon State Legislature directed the Department of Energy to develop incentives that accelerate deployment of heat pumps and creation of community cooling centers. The Community Cooling Center Grants, administered by a nongovernmental entity, will assist landlords in creating or operating one or more private community cooling spaces for tenants of multifamily housing properties, especially those without in-unit cooling and who serve vulnerable populations. The legislation initially appropriated \$2 million for the program. Learn more about the Community Cooling Center Grants: <https://www.oregon.gov/energy/Incentives/Pages/heat-pumps.aspx>

Example: Baltimore City Community Resiliency Hub Program

The City of Baltimore has 17 resiliency hubs situated in its most climate-vulnerable neighborhoods. These hubs serve as spaces where vulnerable neighbors can gather in times of emergency; access reliable power for their essential devices; receive supplies, food and drinking water; and store medications sensitive to temperature. While funded by the City, the hubs are operated by trusted, service-based non-profit community organizations, including churches and other faith-based organizations. Learn more about the Community Resiliency Hub Program: <https://www.baltimoresustainability.org/baltimore-resiliency-hub-program/>



D. Address extreme heat in building codes and urban development

Urban design and building codes are important tools to improve individual and community heat resilience, either by incentivizing building features that reduce heat exposure or prohibiting features or ordinances that increase vulnerability. At the individual household level, residential and commercial codes (which include multifamily housing) can address heat vulnerability through optimizing solar heat gain coefficients standards for windows, instituting insect screen standards to encourage nighttime ventilation and cooling and preventing the prohibition of window AC installation on multifamily housing, among others.

The whole community can benefit from code changes that reduce the urban heat island effect through improvements such as cool roofs (above and beyond the aggressive efficiency and decarbonization work already done by the State Building Code Council). We encourage further exploration of using incentives, procurement, ordinances, design guidelines, zoning codes and building standards for both new development and existing housing stock to reduce individual and community heat vulnerability. Washington state could facilitate planning guidance adoption through the Department of Commerce, which administers the state's Growth Management Act.⁷ Commerce is currently developing model climate element planning guidance for local comprehensive plans,^[37] in accordance with state legislation from 2021.



Example: San Antonio's Under 1 Roof

As part of the City of San Antonio's Home Rehab Programs, Under 1 Roof is a residential roof repair program that replaces worn or damaged roof shingles with white shingle roofs and solar underlayment that reflect heat and improve energy efficiency. The program serves low- to moderate-income homeowners and prioritizes underserved areas of the city. Early studies found reflective roofs lowered home temperatures by up to 14° F, reducing the burden of electricity costs while also making small but meaningful improvements to the local heat island effect. Learn more about Under 1 Roof: <https://www.epa.gov/heatislands/cool-fixes-hot-cities-part-1-san-antonio>

⁷ During the 2023 legislative session, House Bill 1181 was passed into law mandating the inclusion of climate change in comprehensive planning under the Growth Management Act.



E. Increase tree canopy and shade structures

Shade can drastically reduce surface temperatures, making individuals more comfortable and reducing the urban heat island effect. Several studies found that the shade provided by trees or surface-covering vegetation such as vines can reduce surface temperatures of buildings and pavement as much as 20-40°F relative to fully sun-exposed surfaces.[38] Non-natural shade performs just as well.[39] However, the cooling effect of shade from an individual tree or canopy is localized, so effectively reducing heat stress necessitates strategic siting of shade structures and vegetation where people are most likely to be subjected to excessive heat — in buildings without AC and exposed public spaces.[40] Putting shade outside of building windows is particularly effective, and also reduces AC energy costs. Actions to increase the urban tree canopy can require collaboration among a wide array of actors, including individual homeowners, homeowner associations, commercial property owners and multiple local and state agencies (e.g., city/county parks departments, planning agencies, transportation agencies, sustainability offices). The multiple benefits of tree planting campaigns mean they take advantage of a wide array of funding streams, including Hazard Mitigation Grants administered by Washington’s Emergency Management Division.

Example: Shade tree policy in Chula Vista (CA)

The City of Chula Vista (CA) City Council adopted an ordinance that required shade trees to be incorporated into all new public and private streets as well as all new

private development parking lots. The ordinance requires development plans to achieve 50% canopy cover over parking spaces within five to fifteen years of planting. This ordinance provides an example of using regulations strategically to harness the power of private development to reduce heat vulnerability locally. Read Chula Vista’s shade tree policy ordinance: <https://www.chulavistaca.gov/home/showdocument?id=8093>

EQUITY IN SPOTLIGHT: GREENING WITHOUT GENTRIFICATION

Tree plantings and investments in historically marginalized urban areas can contribute to “green gentrification,” a process in which resulting property values increase, thereby pricing out the vulnerable low-income communities these efforts are meant to serve. To limit this effect, several states and cities have paired anti-displacement strategies such as rent control, inclusionary zoning and affordable housing projects with urban greening initiatives. A cross-sectional survey of parks-related anti-displacement strategies across the United States found that starting anti-displacement strategies before announcing greening initiatives had the best outcomes for greening without gentrification. Learn more about this study: <https://www.ioes.ucla.edu/project/prads/>



F. Improve access to cooling devices in low-income households

Spending time in places with AC, even at short intervals, is one of the safest ways to help the body regulate its internal temperature, thereby decreasing the risk of heat-related illness and death.[41][42] Because of its historically mild summers, cooler areas of Washington have lagged far behind the rest of the country in use of residential AC. More vulnerable populations, such as low-income households and renters continue to lag far behind national averages. Only 34% of households that earn \$50,000 or less in King, Pierce and Snohomish counties have AC in their home, and just 29% of rented houses in these three counties have them installed.[43] Heat pumps are an alternative to AC that cool indoor environments more efficiently, reducing energy costs and emissions associated with electricity production. State and local governments can reduce extreme heat health risks for these vulnerable populations by subsidizing cooling devices and eliminating barriers to installing heat pumps or AC units for low-income, high-risk households.

Example: Oregon Senate Bill 1536

In the aftermath of the 2021 heat dome, the Oregon State Legislature passed a flurry of legislation that sought to improve heat resiliency, including Senate Bill 1536. Among other things, this bill prohibited landlords from restricting a tenant from installing or using a portable cooling device (like window AC units) of the tenant’s choosing with certain exceptions. Learn more about this legislation: <https://olis.oregonlegislature.gov/liz/2022R1/Downloads/MeasureDocument/SB1536/Enrolled>



FUNDING IDEA: USING MEDICAID DOLLARS

Recent changes to Medicaid in Oregon allow the state to provide “health-related social needs” services to individuals and families on Medicare or Medicaid. The program allows Oregon Health Plan, Oregon’s Medicaid and Children’s Health Insurance Program, to cover the costs of devices that maintain healthy temperatures and clean air, including ACs, heaters, air filters, and generators to operate devices when power outages occur. Learn more about Oregon’s updated policy: <https://www.oregon.gov/oha/hsd/medicaid-policy/pages/waiver-renewal.aspx>





G. Expand energy assistance programs for cooling

AC units are only good insofar as they are used. Studies have shown low-income households are likely to refrain from using home AC to avoid high utility bills when they are already overburdened with housing costs.[44][45] The single largest energy assistance program available to low-income households is the U.S. Department of Health and Human Services’ Low Income Home Energy Assistance Program, which in Washington state is administered by the Department of Commerce. This program provides individual households at or below one-and-a-half-times the federal poverty level with financial assistance to reduce the costs associated with home energy bills, energy crises, weatherization and minor energy-related home repairs. Perhaps because extreme heat is a relatively new hazard in Washington, Commerce does not dedicate program dollars toward cooling assistance in their model plans,[46] although local community action agencies who assist Commerce in determining eligible households have been able to help through crisis assistance funds.[47] Unfortunately, without adding additional resources targeted at cooling assistance, using program funds in this way reduces funds available for weatherization and heating assistance. The Washington Utilities and Transportation Commission and Washington state Public Utility Districts also have a role to play in ensuring cost does not discourage low income households from using AC during extreme heat events.



H. Improve protections for workers

Washington State Labor & Industries adopted temporary emergency rules in 2021 to enhance protections for outdoor workers in accordance with data on occupational heat-related illnesses,[48] and after stakeholders petitioned for more specific protections. There are currently estimated to be more than 395,000 Washingtonians who perform outdoor work,[13] with the highest rates of reported heat-related illnesses in agriculture, construction and public administration (which includes fire protection).[48] As of this writing, Labor & Industries is working to make updated outdoor heat exposure protections permanent, such as additional requirements for shade and paid rest breaks and lowered



temperature thresholds at which certain preventative actions must be taken.[49] Labor & Industries anticipates a second phase of rulemaking to extend ambient heat exposure protections to indoor workplaces.[50] However, workers’ rights groups have voiced concern that rules are inadequate if not coupled with sufficient enforcement,[51] while others worry such rules will cut into farmworkers’ take home pay, as many are compensated on a piece rate or percentage basis rather than an hourly wage. In addition to what Labor & Industries is already considering, below are some considerations for improving protections for workers:

- Ensure timely adoption of an indoor heat standard to protect workers subjected to extreme heat in buildings without sufficient ventilation or cooling systems in place.
- Increase the duration and/or frequency of cool down rest periods at high levels of heat stress, and consider acclimatization protocols to enhance worker adaptation to heat.
- Increase enforcement and inspections, especially during the first few days of extreme heat when the risks of heat-related illness are greatest.
- Ensure outreach to employers and workers on workplace safety, health rules and rights, especially workers under temporary work visas and those who are undocumented.
- Ensure awareness of and compliance with Washington wage and hour rules requiring rest period compensation for piece-rate or percentage-based workers.[52]

Example: Oregon's Indoor & Outdoor Heat Standard

Oregon has a standard that covers both indoor and outdoor heat exposure. Under the Oregon standard, increasing protections are required as heat stress increases in both the indoor and outdoor environment. Learn more about about Oregon's heat standard: <https://osha.oregon.gov/OSHARules/adopted/2022/ao3-2022-text-alh-heat.pdf>



I. Intra- and inter-governmental coordination to consider health in all policies and drive implementation

As the resilience strategies above demonstrate, the authority to protect Washingtonians during extreme heat emergencies spans conventional boundaries of government agencies and levels of government. In many cases, the most effective strategies are in the control of institutions without a public health mandate, without funding to address public health issues, and/or with other high-priority and competing demands for their attention. Additionally, attention on extreme heat health risks often gets focused, understandably, on the short-term emergency response actions to save lives during an extreme heat event, to the neglect of longer-term risk reduction strategies. Furthermore, while each strategy described above (and many that are not described) can protect public health to some degree on its own, considering the opportunity to improve health outcomes across all policies will be necessary to achieve community-wide reductions in illness and death from extreme heat because different populations are vulnerable in different ways, and because redundancy is crucial when lives are at stake.



EQUITY IN THE SPOTLIGHT: TAILORED POLICIES FOR MARGINALIZED POPULATIONS

The risks of extreme heat are heavily context-specific. Not every vulnerable group will be served by the strategies presented in Section 3. Certain populations at heightened risk of heat-related illness and death are more challenging to serve. This may be due to distrust of government services, language access issues, or social and political pressures like racism or stigma. Reducing vulnerability among these populations will require leadership and creativity. Additional focus on these populations is necessary to prevent the worst impacts of extreme heat. Some higher-risk populations include people who are incarcerated, people who are coping with mental illness, and people who are unhoused.

...considering the opportunity to improve health outcomes across all policies will be necessary to achieve community-wide reductions in illness and death from extreme heat because different populations are vulnerable in different ways, and because redundancy is crucial when lives are at stake.

4. Taking action: Tools and approaches to inform strategies

We recommend, when feasible, moving quickly to implement the strategies described in Section 3. However, we recognize that policy participants face impediments such as limited funding, resources and information gaps. Among many available tools and approaches, we discuss three that can inform users of existing and projected climate and health risks, and assess equity and potential impact of policy strategies: the Climate Impacts Group’s Climate Mapping for a Resilient Washington tool; the Center for Health and the Global Environment’s Climate Health and Risk Tool; and community-level heat assessments: the Spokane experience.

Climate Mapping for a Resilient Washington

One of the most common concerns expressed by institutions and policy actors attempting to implement the strategies in Section 3 is what climate change will mean in their specific location. The Climate Impacts Group at the University of Washington developed the Climate Mapping for a Resilient Washington tool to answer this question across a range of climate hazards, including extreme heat. The tool is integrated into the state Department of Commerce’s aforementioned climate guidance for comprehensive planning,[37] and could be useful to participants engaged in comprehensive planning related to extreme heat who need to justify proposed protective actions to elected officials, or who need empirical information to bolster cost benefit analyses required in some local decisions or state and national grant applications (e.g., Federal Emergency Management Agency Hazard Mitigation Assistance grants).

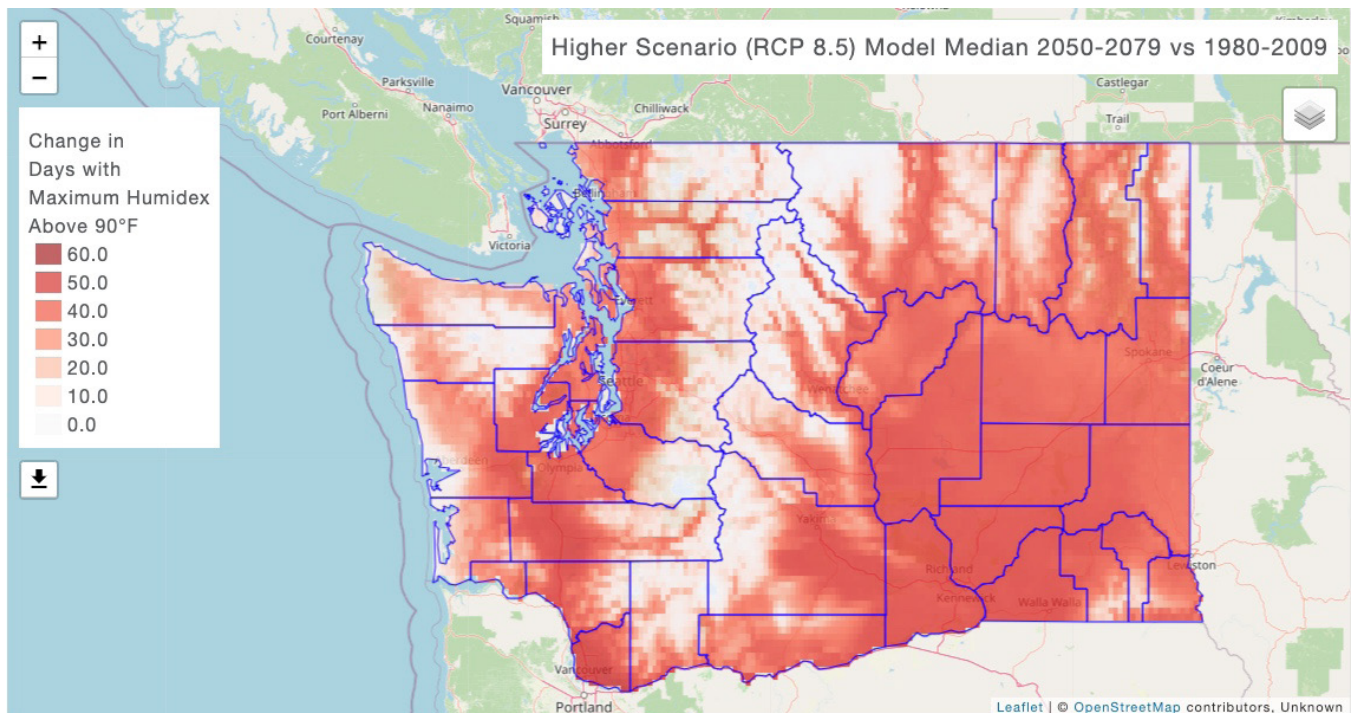


Figure 7: Projected change in days with maximum humidex above 90°F equivalent for Washington state for 2050-2079, relative to 1980-2009 under a high emission scenario (RCP 8.5). The Climate Mapping for a Resilient Washington tool can output maps using different emissions scenarios to illustrate what parts of the state are expected to see the most increase in heat indicators, such as change in days with maximum humidex above 90°F equivalent, in the future. Humidex is a measure of heat that includes both temperature and humidity.

The Climate Health and Risk Tool is operational and updated regularly with additional functionality to ensure the tool provides actionable information. The tool was designed to provide useful information for short-term emergency management decisions at state and local levels and to empower local decision makers in identifying high-risk communities, understanding the place-based drivers of risk, and finding suggestions for short- and long-term risk reduction strategies.

The tool estimates extreme heat health risks at the census tract level (about 4,000 people on average but varying in geographic size). This allows for neighborhood comparisons in some densely populated urban areas, but may provide only a coarse geographic resolution where population is

sparse. The tool includes data layers for variables with causal associations with extreme heat health risks,[54] such as socioeconomic factors (e.g., poverty level, social isolation, race, age), pre-existing conditions (e.g., diabetes, stroke, mental health), and local environmental conditions (e.g., tree cover, AC, mobile homes). The tool provides heat risk levels for five different scenarios: historical (1991-2020) and future (2036-2065) periods using the hottest 30 and 3 days of each year, and the 2021 heat dome. Decision makers can use this information to identify high risk areas, understand risk drivers, and prioritize risk reduction efforts. Learn more about the Climate Health and Risk Tool: <https://climatesmarthealth.org/>

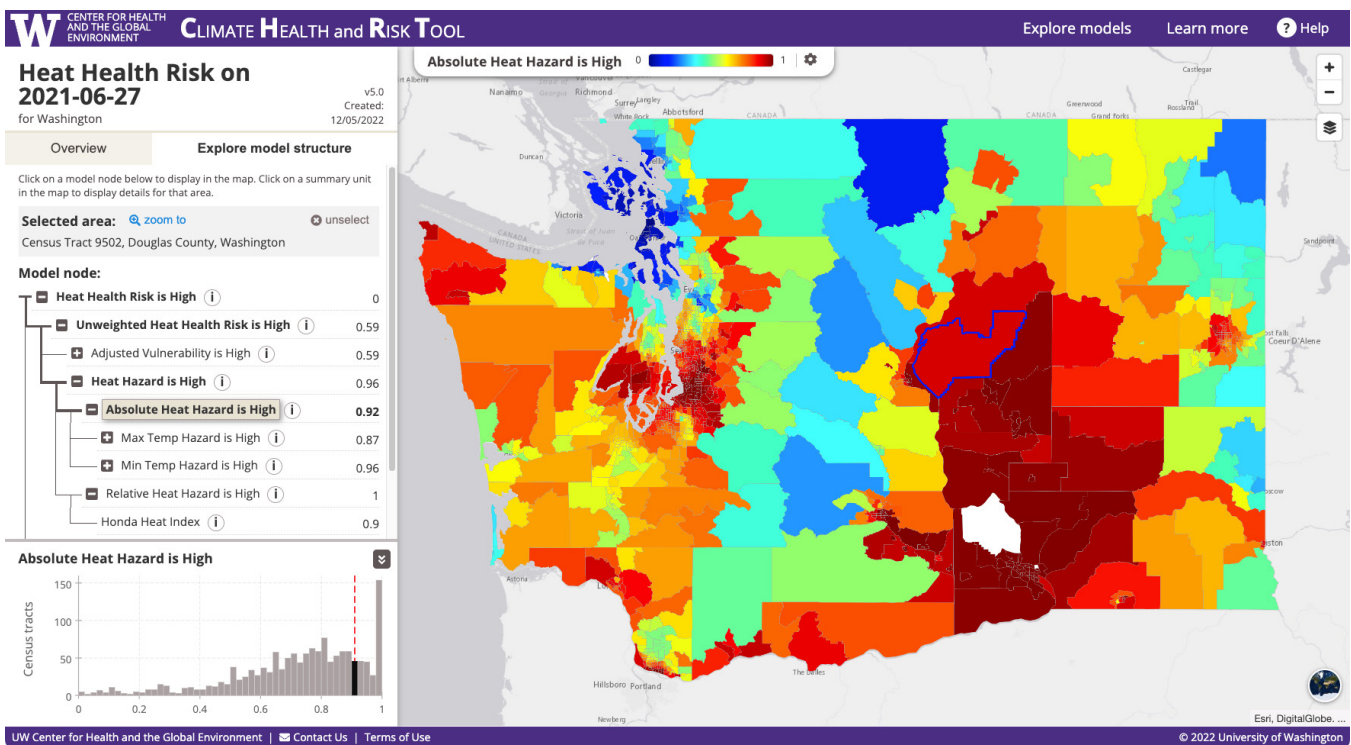


Figure 9: Climate Health and Risk Tool model explorer interface. With the Climate Health and Risk Tool model explorer, users can see how drivers of heat health risk are related to one another (model tree in upper left pane). By selecting a variable in the model tree, they can view the variable's map (right pane) and histogram (lower left pane). Clicking on a census tract in the right pane (here, blue outline in eastern central Washington) populates the model tree with values for that census tract and highlights that census tract's position in the histogram. Clicking on a variable's information icon (circled i) brings up variable-specific details, links and risk reduction information.



EQUITY IN THE SPOTLIGHT: SPOKANE DISCOVERS DRIVERS OF LOCALIZED EXTREME HEAT HEALTH RISKS

Analysis of Spokane's GIS maps shed light on which communities were disproportionately affected and possible drivers of inequities. In partnership with the Washington State Department of Health, the Gonzaga Climate Center discovered correlations between urban heat and race, income and paved surfaces. The research revealed that Spokane community members who live below the poverty line are statistically the most likely to live in an urban heat island — and thus are more vulnerable to heat.[56]

Concurrent with the spatial research component, the Gonzaga Climate Center launched a community-wide survey to better understand community perceptions and experiences of extreme heat. Accounting for demographic characteristics that drive heat vulnerability, the Gonzaga Climate Center ensured that the demographics of the 1799 respondents closely match those of Spokane in general, particularly with respect to age, income and those who identify as Black or Indigenous. Results show that, among other things, 88% of all respondents indicated that they are unlikely to leave their home during an extreme heat event (e.g., to make use of a cooling center). Nearly one-quarter of respondents did not have any access to AC in their home, and, of those who do have AC, one in five respondents report significant (often financial) barriers to using it.[57]

By conducting a community heat assessment to better understand the nature of the problem, the City of Spokane is now in a better position to respond effectively. Case in point, the Gonzaga Climate Center is now working with the Spokane Regional Health District to launch an educational campaign to raise extreme heat health risk awareness, including short videos and fact sheets, and Spokane Mayor Nadine Woodward's administration is leading the creation of extreme heat response plans that ensure the full range of affected people have the support they need during the next heat wave. Learn more about Gonzaga's Beat the Heat campaign: www.gonzaga.edu/BeatTheHeat



Key points

Extreme heat is serious. Heat events kill people, exacerbate chronic health issues like heart and kidney disease, drive injuries, and lead to adverse pregnancy outcomes. These impacts increase 911 calls, ambulance transports, emergency department visits, and hospital admissions. Extreme heat also causes significant individual and collective economic costs.

Some populations are more vulnerable to extreme heat: the elderly; children; pregnant people; those with chronic medical conditions; people living unsheltered, in marginal housing, or in urban heat islands; outdoor workers; people in poverty; and people not fluent in English. Extreme heat has an outsized impact on socially and politically marginalized populations such as low-income households and communities of color.

More Washingtonians will be vulnerable to extreme heat in the future due to the state's aging population, urbanization, and climate change. Climate models project 4 to 6°F summer warming in the Pacific Northwest in the 2050s relative to the last half of the 20th century and the number of extreme heat days is projected to increase on the order of five-fold by the 2050s

We know enough about the risks of extreme heat, the drivers of vulnerability, and ways to protect people to take immediate action.

Recommendations

We recommend individuals, families, health professionals, community-based organizations, and local and state government officials across many agencies take immediate action where they have the authority and resources to act, and sustain a commitment to mitigating extreme heat as an ongoing part of their work, especially people and organizations not driven by a public health mandate.

We recommend maintaining a dual focus on shorter-term emergency response actions to save lives during an extreme heat event and on longer-term opportunities to reduce extreme heat health risks like those described in Section 3.

We recommend pursuing a portfolio of strategies to address extreme heat health risks for a number of reasons: most strategies protect only one vulnerable population while insufficiently protecting others; extreme heat can lead to cascading disasters, like power failures, that limit the effectiveness of some strategies; and redundancy is crucial when lives are at stake.

We recommend accessing and using tools and approaches like those profiled in Section 4 when additional information is needed before implementing strategies to address extreme heat health risks.

We recommend embracing the governance challenge of coordinating and empowering the diverse participants involved in implementing the health protective strategies described in Section 3 as fundamental to saving lives from extreme heat.



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