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Prepared for the hearing “Silent Killer: The Rising Problem of Extreme Heat in the U.S.”
United States House of Representatives, Committee on Space, Science and Technology
Subcommittee on the Environment

21 July 2021

A few weeks ago, during the hottest stretch of the hottest June ever recorded in Boston, a concerned mom asked me an entirely reasonable question: was it safe for her child to play outside?

I know full well, and have witnessed first-hand more times than I care to recall, what heat can do to a child’s body. When heat outside overwhelms a child’s ability to cool off, organs shut down. Asthmatic children struggle to breathe. Children with kidney disease may have their kidney’s fail. And adolescents with depression may take their lives. Heat may even stunt the growth of fetuses developing in utero.

But none of this knowledge helps answer the question I had been asked. The truth is: I had no good answer.

At this late date, when we can already detect the influence of human caused climate change on the severity and frequency of heat waves, we still do not have the knowledge needed to keep most children and adults safe in the heat.

Answers to questions like this mother’s are urgent for many reasons. First, we know that heat kills more Americans than all other natural disasters and, in coming years, extraordinary heat events, like the recent heatwave that killed hundreds in the Pacific northwest, will become more common. Heat can damage every organ in our bodies and sometimes in surprising ways. Heat may, as examples, increase risk for bacterial bloodstream infections, infant mortality, injuries at work and heat related illness in outdoor workers and soldiers.

The pace of warming is now fast enough to make apparent additional harms within a generation. Without rapid substantial action on climate change, more northern and cooler cities, such as Cleveland, as well as more southern and warmer cities, such as Houston, will see dramatic increases in the number of extreme heat days. For Cleveland, a half-dozen or so days will have a heat index above 90 this summer. By 2050, there may be 20 or more. Today Houston has about 10 days with a heat index over 100. By 2050, there may be 60.

Second, heat wave mortality rates, after decades of progress, are starting to head in the wrong direction in some demographic groups, such as men between 45 and 64, and in southern and southeastern states. Air conditioning helps, but in places with the highest availability of air conditioning, more heat still causes preventable deaths. Heatwaves also drive electricity price spikes and power outages. Electricity costs went up four fold in some places during the Pacific Northwest heatwave. These knock-on effects of heat waves promote lapses in air conditioning use that can be life threatening, especially for low-income Americans.

Third, heat also has dramatic, negative effects on our economy. A year with 10 additional 90°F days - as is projected by 2050 in many major cities in the U.S. - may reduce economic output per capita by more than 3% in colder places and more than 1%, in hotter ones (Behrer & Park, 2017). Heat poses exquisite risks to agriculture in the United States. A 2011 heatwave in Texas knocked out $2.5 billion, or just over 10%, of the state's agricultural output. Across the country, for each degree Celsius warming, we can anticipate yields of wheat, corn and soy to fall 5-10%, and that's counting on continued improvements in technologies to boost yields (Zhao et al., 2017). The federal government already pays about $8 billion each year for crops and livestock that have been baked, parched, or drowned (Congressional Research Service, 2021).

Economic losses from heat are most severe in the poorest counties (Hsiang et al., 2017). Heat has particularly regressive effects on low wage workers. Recent research done in California suggests that hot temperatures are responsible for as many as 20,000 workplace injuries, including among people working indoors (Lavelle, 2021). These injuries mean lost wages and higher medical bills for low-income workers across a large swath of industries.

Fourth, heat exacts its heaviest toll on people who have the least ability to protect themselves and recover from it, and in particular low wealth households. In cities around the country, poverty and poor housing quality has been linked to higher rates of hospitalization and death from heat exposure (Son et al., 2019). Lower-income Americans spend the greatest proportion of their income on utility bills and are most likely to not turn on the AC due to cost (Drehobl et al., 2020).

A mountain of evidence demonstrates racial inequities in heat exposure and health outcomes Black Americans and people of color live in neighborhoods that are on average 2 degrees Celsius warmer than non-Hispanic Whites as a direct result of historically racist policies, such as redlining (Hsu et al., 2021).

According to the CDC, Hispanic Americans are 2x, Black Americans are 3x, and Indigenous people are 6x more likely to die from heat as Asian Americans who are least likely to die from heat (Vaidyanathan et al., 2020). These disparities in heat exposure and mortality mean that without action, heat stands to roll back the progress we've made in reducing poverty and racial inequalities.

Clearly, heat puts a tremendous amount at stake for health, equity and our economy. What can we do to better protect ourselves? Let me begin to tackle that question with what we need to learn.

For starters, I would love to be able to tell the families I care for what temperatures warrant caution for their children's' health, and especially for children with medical conditions. The same applies for adult providers, too. To get this knowledge we will need a solid investment from NIH, focused on those most at risk.

While this research advances, we can do a better job of translating what we have learned about older adult's heat risk into terms that are usable by providers and public health officials. Thanks to pioneering work led by the Arscht-Rockefeller Resilience Center, work has already begun to establish city-specific, health-based heat ranking systems in several cities. This intervention must be rigorously studied and connected to mechanisms to prevent harm.

I also want to underscore the need to more closely investigate the potential that medications may increase heat exposure risk. We have preliminary evidence that many mediations, both over the counter and prescription, may be contributing to heat related illnesses.

Next, we have to better assess what we are doing today for heat extremes. We have precious little evidence that heat alerts, which form a foundation of our heat response across the country, protect vulnerable people. Older Americans, for example, who may be at highest risk, may be least likely to see heat as a health risk (Howe et al., 2019). Heat alerts are made when temperatures exceed an arbitrary percentile temperature threshold rather than based on health risk. When heat alerts are given, they often occur at temperatures higher than when harms occur for many people, and especially the most vulnerable (Vaidyanathan et al., 2019).

When cities act on heat alerts they often open cooling centers. We know that people who get to cooling centers are protected but we also have evidence that few people at risk use them. Barriers to accessing cooling centers are many and may include transportation, mobility, social isolation and stigma among others. Cities have started to grapple with the limits of cooling centers and have begun to experiment with localized strategies that rely upon social networks and community organizations to keep people safe. We must study these and other new ways of heat response to see if they work. To do so, support for researchers and local governments is needed.

Another means to fill some of the holes in traditional approaches to heat preparedness could come from engaging the healthcare system. Healthcare providers know the medical conditions of individuals that may increase their vulnerability to heat and have direct lines of communication with them. If only we were incentivized to act to prevent harm. With payment reforms and value based care, which foster actions to keep people well, providers can be given financial incentives to keep people safe during heat events and reduce preventable healthcare overutilization.

To better protect outdoor workers, including farmworkers, we need to improve worker protections. Farm workers have 20 times the risk of workers in other occupations to die from heat (Centers for Disease Control and Prevention (CDC), 2008). We need to invest in studying the interventions that states like Oregon and California have implemented to protect workers, which include requirements for access to shade, drinking water, and training of supervisors, to see how cost-effective they are and continue to find new ways to protect farmworkers, and all workers, from heat as we have evidence that heat drives workplace injuries across sectors.

Finding new ways to protect agriculture itself from more heat and greater water scarcity is likewise critical. Federal agencies, and especially, USDA have a role in providing incentives to improve climate resilience in agriculture.

The vital need for resilience on our nation's farmlands is matched by the need to protect our poorest, most vulnerable citizens from heat who have been shown in study after study to face much greater risks from heat exposure. HUD could work with Medicaid to improve housing quality and find ways to cool environments on and around FHA owned and mortgaged properties and leverage the value that cooler environments provided to lower utility and healthcare costs.

Reducing urban heat is essential. Most of you will know that temperatures in cities are higher than surrounding rural areas because pavement, black roofs, and other features of how cities are built serve to make cities into ovens that soak up heat during the day and release it into the air at night. Many cities have pursued urban greening strategies to reduce heat but greening can provide diverse benefits, from better air quality and lower utility bills, to reduced run-off and better mental health.

If you take away nothing else from my testimony today, take away this: we must take a more full accounting of the many benefits that come from climate actions, such as urban greening, in deciding on infrastructure plans. If only we were as quick to embrace the health and equity benefits of infrastructure proposals as we are to compute their up-front costs, we would realize just how sound many investments in climate action are.

References

Behrer, A. P., & Park, J. (2017). Will We Adapt? Temperature, Labor and Adaptation to Climate Change. *Working Paper*, 39p. http://heep.hks.harvard.edu.

Centers for Disease Control and Prevention (CDC). (2008). Heat-related deaths among crop workers--United States, 1992--2006. *MMWR. Morbidity and Mortality Weekly Report*, *57*(24), 649–653. https://doi.org/10.1001/jama.300.9.1017

Congressional Research Service. (2021). *Federal Crop Insurance: A Primer*. https://crsreports.congress.gov

Drehobl, A., Ross, L., & Ayala, R. (2020). *How High are Household Energy Burdens?*

Howe, P. D., Marlon, J. R., Wang, X., & Leiserowitz, A. (2019). Public perceptions of the health risks of extreme heat across US states, counties, and neighborhoods. *Proceedings of the National Academy of Sciences*, *116*(14), 6743–6748. https://doi.org/10.1073/PNAS.1813145116

Hsiang, S., Kopp, R., Jina, A., Rising, J., Delgado, M., Mohan, S., Rasmussen, D. J., MuirWood, R., Wilson, P., Oppenheimer, M., Larsen, K., & Houser, T. (2017). Estimating economic damage from climate change in the United States. *Science*, *356*(6345), 1362–1369. https://doi.org/10.1126/SCIENCE.AAL4369

Hsu, A., Sheriff, G., Chakraborty, T., & Manya, D. (2021). Disproportionate exposure to urban heat island intensity across major US cities. *Nature Communications 2021 12:1*, *12*(1), 1–11. https://doi.org/10.1038/s41467-021-22799-5

Lavelle, C. (2021, June 15). *Work Injuries Tied to Heat Are Vastly Undercounted, Study Finds - The New York Times*. https://www.nytimes.com/2021/07/15/climate/heat-injuries.html

Son, J.-Y. Y., Liu, J. C., & Bell, M. L. (2019). Temperature-related mortality: a systematic review and investigation of effect modifiers. *Environmental Research Letters*, *14*(7), 073004. https://doi.org/10.1088/1748-9326/ab1cdb

Vaidyanathan, A., Malilay, J., Schramm, P., & Saha, S. (2020). Heat-Related Deaths — United States, 2004–2018. *MMWR. Morbidity and Mortality Weekly Report*, *69*(24), 729–734. https://doi.org/10.15585/mmwr.mm6924a1

Vaidyanathan, A., Saha, S., Vicedo-Cabrera, A. M., Gasparrini, A., Abdurehman, N., Jordan, R., Hawkins, M., Hess, J., & Elixhauser, A. (2019). Assessment of extreme heat and hospitalizations to inform early warning systems. *Proceedings of the National Academy of Sciences*, *116*(12), 5420–5427. https://doi.org/10.1073/PNAS.1806393116

Zhao, C., Liu, B., Piao, S., Wang, X., Lobell, D. B., Huang, Y., Huang, M., Yao, Y., Bassu, S., Ciais, P., Durand, J.-L., Elliott, J., Ewert, F., Janssens, I. A., Li, T., Lin, E., Liu, Q., Martre, P., Müller, C., … Asseng, S. (2017). Temperature increase reduces global yields of major crops in four independent estimates. *Proceedings of the National Academy of Sciences*, *114*(35), 9326–9331. https://doi.org/10.1073/PNAS.1701762114