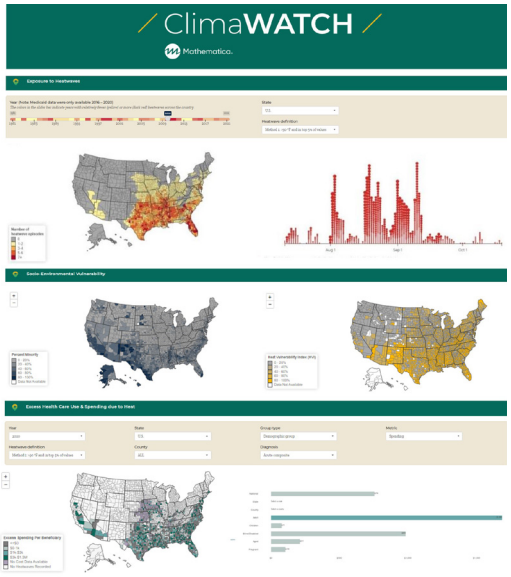
ClimaWATCH

Mathematica

An Interactive Tool for Climate Vulnerability Assessments

Heat waves have caused more fatalities than any other extreme weather event and cost the United States billions of dollars. Many of the hottest urban heat islands, where temperatures can soar up to 20°F higher than in surrounding areas, are inhabited by people living in poverty and by communities of color. Mathematica's interactive **ClimaWATCH tool** helps officials explore how heat waves have impacted health and magnified inequity at the local, state, and national levels. Focusing on Medicaid beneficiaries, ClimaWATCH (Climate and Weather Analytics, Trends, and Community Health) maps and summarizes data on temperature and dew point; vulnerability related to social and environmental factors; and health service use and spending. The tool shows where heat waves concentrate, which communities are most susceptible, how different health effects accumulate, and the financial toll these illnesses take. ClimaWATCH's novel algorithm quantifies excessive health service use and spending attributable to heat waves. Officials can use the dynamic data summaries—provided by demographic group, care setting, and diagnosis—to develop tailored heat action plans that protect vulnerable groups and improve climate resilience.

In summer 2021, northwestern regions of the United States and Canada saw some of the highest temperatures ever recorded—triggering extensive wildfires, infrastructure damage, and several hundred sudden deaths. In 2023, hundreds of uncontrolled Canadian wildfires spurred on by extreme heat toxified the air across much of North America. Heat waves have caused more fatalities than any other type of extreme weather event, and cost the United States billions of dollars. The impacts of heat have not been felt equally. Many of the hottest urban areas are inhabited by people living in poverty and communities of color. In these urban heat islands, temperatures can soar up to 20°F higher than in surrounding areas with more vegetative cover. With high levels of variability in extreme heat exposure, susceptibility, and impacts across the country, climate vulnerability assessments are integral to effective heat action planning.

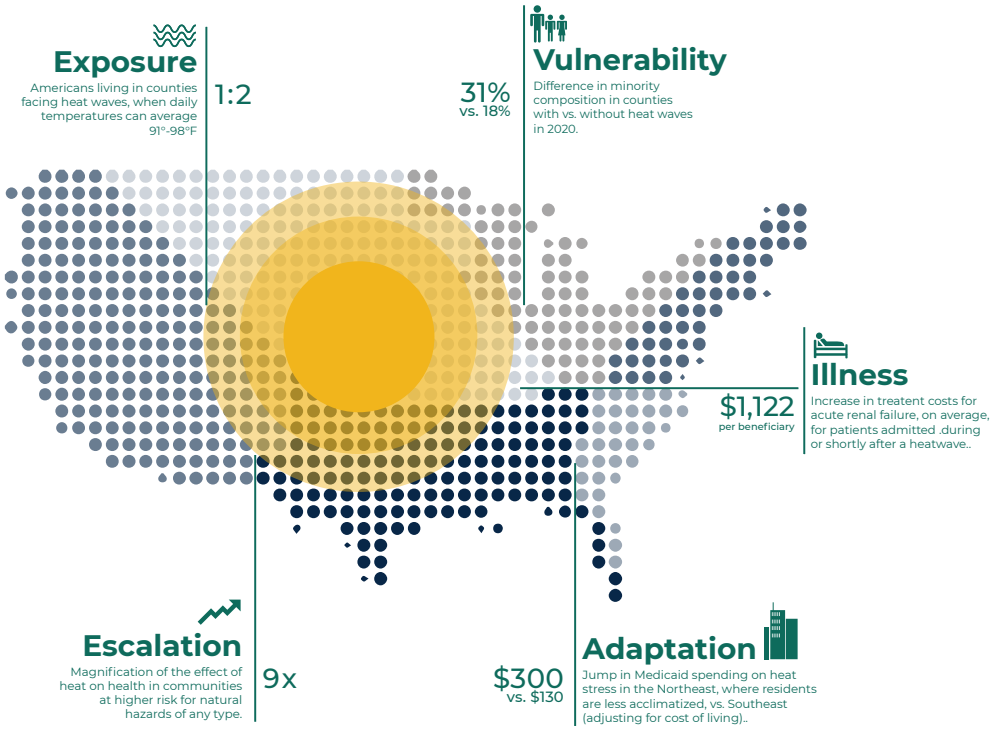


As part of a new Climate Change and Health Analytics initiative, Mathematica has developed an interactive tool that quantifies how heat waves are impacting health at the national, state, and local levels. Leveraging our expertise working with large-scale health policy data sets, ClimaWATCH (Climate and Weather Analytics, Trends, and Community Health) provides county-level maps, graphs, and statistics to (1) identify communities hardest hit by extreme heat, (2) assess which are most vulnerable to them, and (3) quantify excess health service use and spending attributable to heat waves.

Mathematica statisticians, data scientists, and health policy researchers have synthesized national Medicaid claims; county-level indices on vulnerability due to demographic, social, geographic, environmental, and infrastructural features; and localized weather metrics. The ClimaWATCH tool maps and summarizes these data sets to show where heat waves and heat-induced health issues have concentrated, how socio-environmental factors differ in counties with and without heatwaves, and which communities have faced higher rates of direct and indirect health issues due to extreme heat.

The diagnoses we examined extend beyond direct forms of heat stress to include a range of serious and potentially fatal conditions that can be caused or worsened by heat waves—conditions like kidney failure and heart attacks. A unique feature of ClimaWATCH is the application of a case-crossover design to determine which health care visits for these conditions are attributable to heat waves. Using a sequential matching algorithm, we identify and compare health service use and spending on days during or shortly after a heat wave to use and spending on other days without extreme heat, to parse out background use rates and thereby quantify excess health care visits and spending. This approach lets us quantify excess health care use attributable to heat, along with excess Medicaid dollars spent to treat adults, children, blind or disabled, aged, and pregnant beneficiaries.

Through dynamic, data-driven maps and metrics, ClimaWATCH makes it easy to explore how heat-related exposure, vulnerability, and illnesses vary across communities and over time. Such data can help officials anticipate surges in health care utilization, identify who is most at risk, adapt municipal vulnerability planning to address climate-related health inequities, and target scarce resources to high-risk communities to facilitate more equitable climate adaptation efforts.



The ClimaWATCH tool and input data can be extended or customized to specific user needs. For example, we can include hyper-local measures of exposure, risk, and outcomes; bring in data on additional climate-related exposures; and use forecasting and simulation to enable scenario planning and emergency preparedness.

To learn more about Mathematica's Climate and Health Analytics initiative and how you could adapt the ClimaWATCH tool to your needs, visit https://www.mathematica.org/sp/climate-change/climate-action or email Aparna Keshaviah at akeshaviah@mathematica-mpr.com.