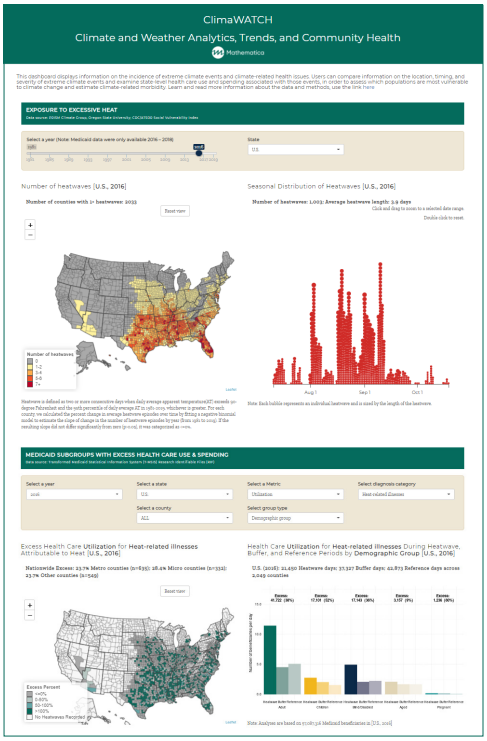
ClimaWATCH

Mathematica

An Interactive Tool to Boost Climate Adaptation and Resilience

Heat waves have historically caused more fatalities than any other extreme weather event and have 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 has developed an interactive tool called ClimaWATCH (Climate and Weather Analytics, Trends, and Community Health) to provide a framework for exploring how heat waves have impacted health and magnified inequity. Focusing on Medicaid beneficiaries, ClimaWATCH combines data on temperature and dew point, social vulnerability and racial composition, and health service use and spending to map 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 on heat-related illnesses. Communities can use the dynamic data summaries—provided by demographic group, care setting, and diagnosis—to better adapt to heat waves and rebound from them more quickly.

In summer 2021, the 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. Heat waves have caused more fatalities than any other type of extreme weather event, and premature deaths and hospitalizations for heat stress have cost the United States billions of dollars. Historically, 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.

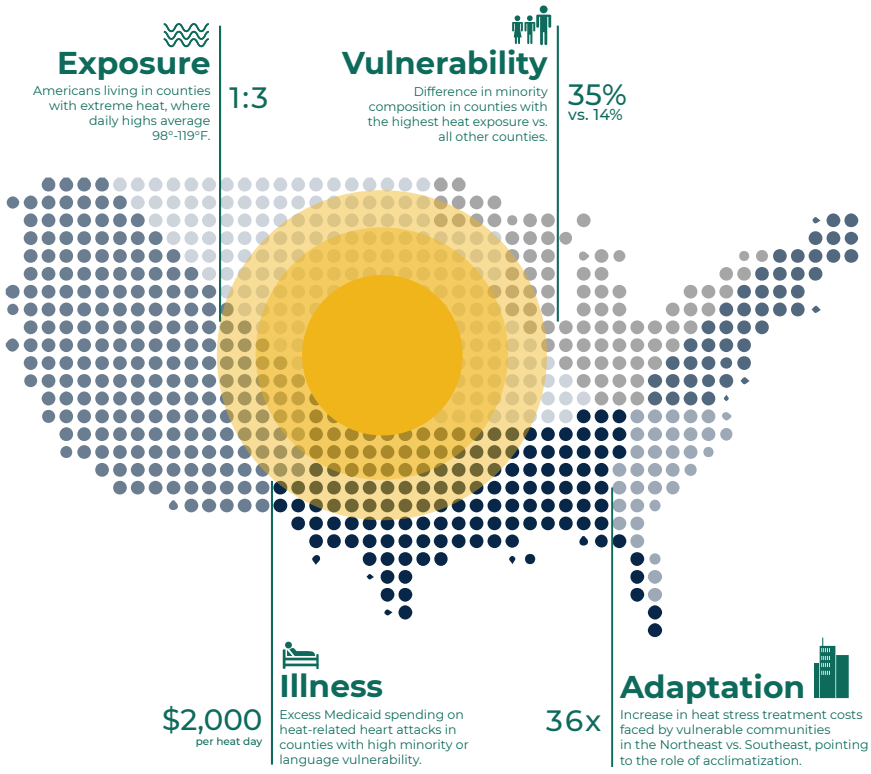


As part of a new Climate Change and Health Analytics initiative, Mathematica has developed an interactive tool that provides a framework for exploring how heat waves are impacting health at the national, state, and local levels. Leveraging our expertise working with large-scale health policy data sets,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

Mathematica statisticians, data scientists, and health policy researchers have synthesized national Medicaid claims for heat-related illnesses, county-level data on social vulnerability and racial composition from the Centers for Disease Control and Prevention's Agency for Toxic Substances and Disease Registry, and hyper-local weather metrics using data from Oregon State University's PRISM Climate Group and the National Centers for Environmental Information. The ClimaWATCH tool maps and summarizes these data sets to show where climate exposures and related acute health conditions have concentrated over time and identify the communities most susceptible to the direct and indirect health impacts of heat waves. As an example, the tool calculates minority composition among counties with and without heatwaves.

The diagnoses we examine extend beyond direct forms of heat stress to include 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 the ClimaWATCH tool 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, to parse out background use rates and thereby quantify excess health care visits and spending. This approach lets us quantify the number of Medicaid beneficiaries with a health care visit for a heat-related illness, along with total Medicaid dollars spent to treat adults, children, blind or disabled, aged, and pregnant beneficiaries.

Through dynamic, data driven maps and metrics, the ClimaWATCH tool makes it easy to explore how heat related exposure, vulnerability, and illness 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 health inequities, and target resources to high-risk communities.



The ClimaWATCH tool's functionality 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 the built environment and additional climate-related exposures; and use forecasting and simulation for scenario planning and emergency response.

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.