Extreme heat impacts daily routines and travel patterns, study finds

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A new study conducted by a team of researchers from Arizona State University, University of Washington and the University of Texas at Austin reveals that extreme heat significantly alters how people go about

their daily lives, influencing everything from time spent at home to transportation choices.

The study, titled "Understanding How Extreme Heat Impacts Human Activity-Mobility and Time Use Patterns," was recently published in *Transportation Research Part D* and underscores the urgent need for policy action as cities around the world grapple with rising temperatures.

The study provides detailed insights into how extreme heat affects daily activity-travel behavior and time use patterns for different socio-demographic groups. It draws on data from the American Time Use Survey (ATUS) and weather data from the National Oceanic and Atmospheric Administration (NOAA), focusing on 11 major U.S. metropolitan areas: Atlanta, Chicago, Dallas, Houston, Los Angeles, Miami, New York, Philadelphia, Phoenix, Seattle and Washington, D.C.

The collaborative effort emphasizes the importance of understanding the effects of extreme heat on everyday activities and mobility choices to inform policy solutions that can address growing climate challenges.

Heat alters daily routines

According to the study, extreme heat significantly reduces the amount of time people spend outside their homes. On extremely hot days, people are more likely to stay indoors, cut back on outdoor activities and avoid non-essential travel.

For instance, the data shows a marked decrease in trips made for leisure, shopping and socializing when temperatures soar. Additionally, people shift their travel to cooler times of the day, opting for early morning or late evening trips to avoid midday heat.

The research shows a clear shift in transportation choices under extreme

heat conditions. Car use increases, while trips made by walking, biking and public transit drop significantly.

On average, public transit trips fall by nearly 50% on extreme heat days, as individuals seek relief in air-conditioned private vehicles. The authors note that this shift presents significant challenges for cities aiming to promote sustainable transportation options like walking and public transit, especially as communities experience climate extremes with greater frequency.

Vulnerable groups face the biggest challenges

The study also found that some groups are particularly vulnerable to the adverse effects of extreme heat. Low-income individuals and those without access to cars are more likely to rely on walking or public transportation, modes that leave them exposed to dangerous temperatures. These individuals are also those with the least flexibility in terms of when and where they work, thus necessitating travel even when temperatures are oppressive.

While higher income individuals reported making significantly fewer trips on extremely hot days, lower income individuals and those without access to a car did not show appreciable drops in daily trip-making, suggesting that they are more vulnerable and exposed to the deleterious effects of extreme heat. The research also highlights that older adults experience greater challenges in adapting their daily routines and risk experiencing social isolation on days when they shelter indoors from the heat.

"We see that extreme heat exacerbates inequities in mobility and activity-travel participation," said Pendyala. "Those who are already at a disadvantage, such as low-income individuals or those dependent on public transportation, face even greater risks during heat waves. This is a

clear call for targeted policy interventions to protect the most vulnerable population groups."

Policy recommendations to tackle the heat

Considering these findings, the authors propose a range of policy recommendations to help mitigate the impacts of extreme heat on communities. These include creating shaded public spaces, offering vouchers for on-demand door-to-door transportation for vulnerable populations and declaring "heat days" when people are encouraged to stay indoors, excused from traveling to the workplace, and able to access cooling centers if their homes are not adequately temperature controlled.

In other words, the study calls for declaring "extreme heat" days that are similar to "snow" days when workplaces, businesses and schools are often closed to protect the public. Urban design improvements such as planting more trees and using heat-reflective materials on pavements can also help make cities more resilient to rising temperatures.

"Addressing the challenges associated with extreme heat is not just a matter of urban design, but of equity and public health and well-being," said lead co-author Irfan Batur. "We need to take decisive action to ensure that our cities are equipped to protect all residents from the dangers of extreme heat."

A warming future requires adaptation

With extreme heat events becoming more frequent and severe due to climate change, the study's findings are especially timely. The research highlights the critical need for cities to incorporate heat mitigation strategies into their transportation and urban planning efforts.

The team hopes that their findings will prompt policymakers to take immediate steps to create more heat-resilient cities.

"This research sheds light on how heat can disrupt daily life and travel in ways that are potentially harmful for the most vulnerable population groups," Pendyala noted. "Our goal is to provide the evidence necessary to drive meaningful change."

The research was led by Ram M. Pendyala, a professor at ASU's School of Sustainable Engineering and the Built Environment, along with co-authors Irfan Batur, Victor O. Alhassan, Mikhail V. Chester and Steven E. Polzin from Arizona State University; Cynthia Chen from the University of Washington; and Chandra R. Bhat from the University of Texas at Austin.

More information: Irfan Batur et al, Understanding how extreme heat impacts human activity-mobility and time use patterns, *Transportation Research Part D: Transport and Environment* (2024). DOI: 10.1016/j.trd.2024.104431

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