

# Researchers measure the dangers of indoor heat

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Lynée Turek-Hankins, center, points to a graph showing temperature fluctuations inside of a Miami-Dade household, as Nkosi Muse, left, and Mayra Cruz look on. Credit: University of Miami

Inside a small cinderblock home superheated by the sun, a single mother and her two children rely on an old air conditioning unit for relief from the dangerously hot and humid weather that grips Miami-Dade County.

But not even the smallest comforts can escape the harsh consequences of life. An unpaid electric bill, long past the grace period, meant that the utility company would soon cut power to the home, leaving the woman and her family to live in a dwelling in which the daytime indoor temperatures can be as hot as outside.

So, the mother turned to the only solution she knew: pawning her laptop for the cash she needed to keep the electricity on.

Such is one of the many stories a team of University of Miami graduate students documented as part of an ongoing study that examines extreme heat's impact on vulnerable Miami-Dade County residents and advances solutions to mitigate its harmful effects.

"We reached out to and engaged residents throughout the entire county, trying to understand their experiences with indoor heat—specifically, how they are being impacted by temperature and humidity in the household," said Lynée Turek-Hankins, a doctoral candidate in the University's Abess Center for Ecosystem Science and Policy and one of five graduate students conducting the core of the research for the project Training in Heat-Related Equity and Disparities, or [THREAD](#).

The project, part of the University of Miami Laboratory for Integrative Knowledge (U-LINK) that addresses complex challenges in climate, health, and other areas, recently received renewed funding.

In the study's critical second phase, Turek-Hankins, along with fellow Ph.D. student Mayra Cruz, spent an entire summer visiting some 59 households across Miami-Dade County, deploying environmental sensors in those homes and interviewing residents about the way heat and humidity impact their lives, whether it be by exacerbating their existing underlying health conditions or causing higher energy bills.

From Allapattah to El Portal, Homestead to Hialeah, and Liberty City to Little Havana, Turek-Hankins and Cruz canvassed several neighborhoods in the county, interviewing the young and the old, the healthy and the infirmed, the poor and the middle class.

Catalyst Miami, a nonprofit that helps solve issues adversely affecting low-wealth communities, helped the two to identify households for their fieldwork, using a survey of residents who self-identified as being too hot in their homes and said they were willing to participate in the study.

Turek-Hankins and Cruz logged more than 800 miles between them, driving to homes to deploy sensors and to conduct interviews, then returning to those sites to collect the devices. Sometimes, they traveled together or teamed with a Catalyst Miami representative.

"I wasn't expecting to see the level of vulnerability we encountered," said Cruz, a Ph.D. student in [environmental science](#) and policy at the Abess Center. "There were households with multiple people living there, many of them dealing with health issues and other problems like housing that isn't weatherized, or they're renting and don't have a lot of say about their AC system and how it's maintained. And there were financial insecurity issues. So, it's a trifecta of health, housing, and financial insecurity amplified by extreme heat."

The data from the sensors, which recorded temperature and humidity inside the homes every 10 minutes, is being analyzed. But preliminary analysis already has yielded some interesting findings, such as homes where [indoor temperatures](#) soared as high or higher than those outside when the air conditioner was not running.

"It used to be that not only were the seasons of hot and cold shorter in Miami, but temperatures would drop during the nighttime. The heat that got radiated dissipated in the night air, and the next morning you started

with a fresher slate. What's happening now is we're not getting that cool down," said Joanna Lombard, a professor in the School of Architecture and expert on the built environment, noting the increasing number of masonry-built homes in the county that retain heat.

"Not everyone's house cools down at night, and everyone can't just open a window or turn the AC down to a comfortable temperature," said Kilan Ashad-Bishop, a cancer disparities and equity postdoctoral fellow at Sylvester Comprehensive Cancer Center, part of the Miller School of Medicine, and a co-principal investigator on THREAD. "The qualitative portion of this project is something that I'm really excited about. We're allowing people to share different dimensions of how they manage not only exposure to heat but also how they adapt to it."

The second phase of the study comes as oppressive heat continues to bake South Florida, prompting the National Weather Service to issue multiple heat advisories for the region. The soaring temperatures and myriad heat alerts are a sign of what's in store for the state, according to climatologist Amy Clement, a professor of atmospheric sciences at the Rosenstiel School of Marine, Atmospheric, and Earth Science and one of the co-principal investigators for the study.

"There's no downplaying this; it's much hotter today than it was more than 50 years ago, and it's clearly evident because we're experiencing many more days with temperatures above 90 degrees [Fahrenheit]," Clement said.

"And that's related to climate change. As the Earth continues to warm, it will keep happening—the number of high heat index days will go up," Clement continued. "What's also critically important to know is that other parts of the country will become more like Florida in the sense that they'll be exposed to long bouts of extreme heat rather than just periodic heat waves. The actions we take here to alleviate this can be a model for

other parts of the country and even the world where heat goes from being an acute threat to a chronic threat."

During the interview process for the study, residents proposed a laundry list of ideas they would like to see enacted to help them deal with the impacts of Miami-Dade County's harsh heat, from better energy savings and assistance programs to more tree canopy in their neighborhoods to weatherization initiatives to protect their homes from the outside elements.

"Many of them are caught in a conflict of trying to keep their energy bill low while staying comfortable, cool, and safe inside their homes," Cruz said. "And that's where we saw people trying to make these extremely difficult decisions, which led to dangerous trade-offs such as not turning on their air conditioner. We had one case where a resident with a heart-related illness turned off their AC completely to keep the electric bill low and another case where the AC was broken, but the resident just couldn't afford to have it repaired. Those were just two cases in our sample. Multiply that out, and I'm sure there's thousands more households that are in similar situations."

Cruz and Turek-Hankins will share the residents' list of recommendations with social organizations with hopes that new programs and services will be created. According to Cruz, they also intend to reconnect with residents to share what they've learned and to see how the residents are doing.

While the two have done the bulk of the boots-on-the-ground fieldwork for the project, their efforts are but one component of the multifaceted study.

Using satellite telemetry, Nkosi Muse, a Ph.D. candidate in environmental science and policy, is analyzing land surface temperature

patterns in different Miami neighborhoods, studying whether some areas may be warmer at the surface than others and how such a characteristic may lead to hotter air temperatures in those enclaves.

"Across most of the literature, it's been found that when the ground is extremely hot, the air above it is also very hot," Muse said. "We want to use the high-resolution data from satellites to conduct social vulnerability analyses for different areas in the county. Is it warmer in areas with underrepresented or lower-income populations? That's what we intend to find out."

Muse often accompanied Cruz and Turek-Hankins on their visits to Miami-Dade households. Collectively, they have come to be known as the Super Heat Trio. "And there's a good reason for that," said Katharine J. Mach, professor of environmental science and policy at the Rosenstiel School, who mentors the three. "Through complementary interdisciplinary research methods, they are cracking open essential insights into the threat of chronic humid heat in this region and how it emerges from the urban geography as well as structural inequities throughout our society. All three are already science–policy leaders in regional and national climate responses to our intensifying heat crisis."

Meanwhile, Rosenstiel School master's degree student Austin Bozgoz, who previously used meteorological data to develop metrics that show how Miami-Dade County's heat is unique compared to other parts of the United States, is developing projections of future heat conditions in Miami.

And Scotney Evans, associate professor of educational and chair of the Department of Educational and Psychological Studies in the School of Education and Human Development, community well-being Ph.D. student Monique Mahabir, and counseling psychology Ph.D. student Margo Fernandez-Burgos are mapping the local network of organizations



addressing climate- and heat-related issues.

"Research can tell us many things about extreme heat, but that's insufficient for making changes," Evans said. "What contributes to change are the organizations on the ground doing front-line work. Our goal is to understand who those organizations are, in what ways they're working together, and how they're crossing sectorial boundaries."

He and Mahabir are mapping everything from nonprofits and local government entities to private sector organizations.

"Rising heat levels are causing harrowing inequities; and unfortunately, these inequities are even lethal," said Mahabir, noting 29-year-old farmworker Efraín López García, who died last month while working outdoors at a Homestead farm in the scorching heat. "Though there are various entities in Miami trying to address extreme heat, these efforts are best productive through collaboration," she added. "It is important to me that I do my part in assisting in the facilitation of communication, collaboration, and action. I am excited to learn from the different entities addressing [extreme heat](#) and see how I can best assist."

The data produced by THREAD will add considerable traction to the conversations around [heat](#) that are taking place in the county, noted Turek-Hankins. "It's not a cookie-cutter type of experience," she said. "It's a whole swath of different people who are experiencing different aspects of the problem."

Provided by University of Miami

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