

Researchers eye personalised heat advisory for those at risk

Study aims to establish heat thresholds for vulnerable groups

Cheryl Tan

People who are more vulnerable to heat stress may face greater challenges as climate change nudges up temperatures in Singapore.

This is where researchers believe a personalised heat advisory will help.

With it, such people can better regulate their time in outdoor physical activities and avoid heat-related risks such as loss of muscular strength and even heat stroke.

The advisory is one of the aims of a study led by Associate Professor Jason Lee from the Human Potential Translational Research Programme at the National University of Singapore's Yong Loo Lin School of Medicine.

The study will look to establish the thresholds for the vulnerable groups to determine how well they will cope in Singapore's current weather and in scenarios of temperature rise due to global warming.

Prof Lee said: "Excessive heat strain – caused by prolonged activities outdoors – could lead to greater health risks, especially for certain groups of people."

The risks include cognitive impairment or poorer decision-making abilities, and reduced cardiovascular endurance, making the heat work harder.

In some severe cases, individuals may be at risk of heat stroke, which may lead to damage to one's brain, heart and kidneys.

The study, which is part of the Cooling Singapore project, a research initiative funded by the National Research Foundation, will focus on three vulnerable groups:

- Primary school pupils.
- Adults not acclimatised to Singapore's hot and humid weather – for example, tourists and those leading long-term sedentary lifestyles.
- Those aged 65 and above.



Visitors at Wild Wild Wet water theme park in September. Associate Professor Jason Lee noted that children's heat tolerance could have been reduced, as they are now spending a lot less time playing and exercising outdoors than before. Childhood obesity is also on the rise and is often related to poor heat tolerance.
ST PHOTO: LIM YAOHUI

For children, it may be a case of enabling parents to feel confident about their kids going out to play.

Prof Lee said: "Parents... may be overprotective of their children and could be unwilling to let them play outside if they perceive the weather to be too hot."

"But if we could establish the child's thresholds under different climatic conditions, children could then play outdoors safely, say within a stipulated time frame, while averting possible heat stress."

He noted that children's heat tolerance could have been reduced, as they are now spending a lot less time playing and exercising outdoors than before.

In addition, childhood obesity is on the rise and is often related to poor heat tolerance.

The study will be conducted in a laboratory setting, with environmental conditions mimicking current and projected temperatures in Singapore.

To ensure that these simulated conditions are as realistic as possible, the amount of heat stress an individual may face in direct sunlight will be taken into account.

This is known as wet bulb globe temperature, which measures dry temperatures, humidity, wind speed and the amount of cloud cover, which influences

solar radiation.

Participants will then be asked to do a series of exercises under a range of climatic conditions, where data such as their body temperature, gait and cognitive functions will be gathered and studied.

As different segments of the population tolerate and experience heat differently, the data from the study will be used to derive a personalised heat-health index that incorporates an individual's physical health with real-time climate conditions to identify their threshold.

This would help them avert the possibility of excessive heat strain.

Prof Lee said: "At current temperatures, one's physiological threshold may be reached after a 30-minute run, for example."

But in a hotter, more humid condition, the same threshold may be reached after a 20-minute run, he added.

"Such information can help people shape their behaviour accordingly as Singapore becomes hotter over time," he said.

The advisory will also include some precautions that individuals should take, such as more frequent rest during workouts, or cooling interventions such as cold showers.

The three-year study, which started on Oct 1, will involve about 120 participants.

Once the thresholds for these vulnerable groups have been established, future research work will look at the physiological thresholds for those with diseases such as diabetes and cardiovascular disease, and people with disabilities.

For instance, those with spinal cord injuries are known to have their ability to regulate heat affected due to damaged connections between the body and the brain, Prof Lee said.

Eventually, he hopes to develop an app that will give prescriptive and personalised heat-health advisories targeting different segments of the population.

He said: "This app could be especially useful during the transition months – from rainy or cooler weather to hotter, sunnier weather, where people would need to adapt and make adjustments to their exercise regime, for example."

An algorithm could also be developed, taking into account climatic conditions, clothing and one's physical health, he added.

"Having such feedback could improve the accuracy of our heat-health advisory to both prevent excessive heat exposure and encourage outdoor physical activities at a personalised level," he said.

tansuwen@sph.com.sg

Move to gauge impact of rising temperatures on people and forests

Scientists here will be conducting a series of studies to better understand the impact of Singapore's rising temperatures on human health and on natural ecosystems such as forests.

As part of the second phase of the Cooling Singapore project – a National Research Foundation-funded initiative – the studies will look into various urban climate risks, leveraging modelled temperature projections, said Associate Professor Winston Chow, the lead principal investigator of the project.

The climate scientist at the Singapore Management University will be mapping the changes in the spatial and temporal patterns of heat in Singapore to determine areas that are more vulnerable to heat.

One of the studies will look at how a range of different warming scenarios – determined by emissions of greenhouse gases – combined with urban development might worsen the heat in Singapore, said Prof Chow.

Aside from these environmental factors, it will also take into account local heat adaptation and mitigation measures, for instance, reducing the waste heat from air-conditioning and implementing urban design that enables cooling via channelling wind flow.

The impacts on different groups of people, including the very old, very young and those who spend a lot of time outdoors, such as construction workers, will also be studied.

The studies will run complementary to the Digital Urban Climate Twin or Duct, a model that looks into Singapore's climate at the micro and regional scale, incorporating data on local buildings, traffic and vegetation that could affect outdoor temperatures.

The tool, which will be completed by 2023, can help policymakers determine the different mitigation measures that could reduce urban heat and improve outdoor thermal comfort at the precinct and nationwide levels, he added.

Associate Professor Jason Lee, principal investigator of the project looking at the impact of heat on the health of certain vulnerable groups, noted that having knowledge of the demographics of various regions in Singapore can help the team to offer more targeted heat advisories.

"For example, if an estate is identified as one of the hotter regions in Singapore, but predominantly composed of young adults, we would be able to tailor our advisory accordingly."

"This will be different compared with another estate where there is a high population of elderly people," said Prof Lee, who is from the Human Potential Translational Research Programme at the National University of Singapore's Yong Loo Lin School of Medicine.

He will be studying the physical thresholds of three vulnerable groups – primary school children, adults who are not acclimatised to Singapore's hot and humid weather, and those aged 65 and above – and eventually hopes to derive a personalised heat-health advisory on how they can undertake outdoor activities safely as temperatures rise.

The third aspect of the project, led by Nanyang Technological University's Assistant Professor Perrine Hamel of the Asian School of the Environment, will look at how resilient Singapore's tree and vegetation species are in the face of rising temperatures and humidity levels.

Prof Chow said: "One of the key points from our Cooling Singapore work so far is the important role green spaces play in reducing air temperatures and in providing shade structures, which will have a massive impact on one's thermal comfort when outdoors."

However, the concern is that if temperatures increase in the coming years, it would be important to study how resilient these trees continue to be.

"If they are at risk of heat, just like we are, then how would the efficiency and efficacy of these trees be compromised in terms of reducing urban warmth?" he added.

The three studies will be completed by 2025.

Cheryl Tan