

Nearly half of over 400 HDB flats warmer than outdoors: Study

Poor airflow among factors; those affected include elderly and lower-income residents

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Some homes in Singapore may not give their residents the best refuge from the heat.

A research group led by the Singapore University of Technology and Design (SUTD) found that nearly half of more than 400 Housing Board flats it visited were warmer than the outdoors, largely as a result of poor or impeded airflow.

Occupants of these homes included the elderly and lower-income families, many of whom were resigned to the heat.

Around one-third of the households were up to 2 deg C warmer than their immediate void decks, and around 10 per cent of homes were up to 5 deg C hotter.

These readings were based on the heat index, which combines air temperature and humidity to estimate overall thermal conditions and potential heat stress.

Close to 60 per cent of the households also had lower airflow than the outdoors, pointing to widespread limitations in natural ventilation when clutter, home layouts, closed windows, or building arrangements impede wind flow.

These were some of the findings of nine months of home visits from October 2024, with researchers going to 10 neighbourhoods across the island to map 416 HDB flats and survey more than 1,000 residents.

Almost all HDB flat types were accounted for, from one-room rental units to executive flats.

In one home, the heat index was 35.9 deg C, even though it was 31.1 deg C outdoors, said Dr Harvey Neo, a professorial research fellow at SUTD's Lee Kuan Yew Centre for

Innovative Cities, who is leading the overall research project, Climate Resilient Citizenry.

In 1 per cent of homes, the difference was even wider, with one home recording 36.2 deg C when it was 27.8 deg C outdoors, he added.

"We found that higher levels of indoor clutter and keeping windows closed for long periods were associated with warmer homes and poorer ventilation. When airflow pathways are blocked, heat accumulates indoors and is slow to dissipate."

Some appliances like refrigerators and cooktops emit heat, and concrete walls and floors release stored heat hours after outdoor temperatures reach their peak.

This is the first study here where researchers have ventured into homes to find out how residents are affected by urban heat, how they keep cool, and if they had conducive home environments.

The multi-institute project also involves the NUS Yong Loo Lin School of Medicine (NUS Medicine), the Singapore-ETH Centre and Singapore Management University.

The findings were put together in a report released in April.

The report noted that seniors, low-income families and residents of smaller homes and rental units are more vulnerable to rising temperatures, and yet have less access to cooling options and air-conditioning.

Singapore is in the midst of the hottest period of the year, with countries in the region, including Thailand and Malaysia, currently experiencing heatwaves. Temperatures are set to rise even more, with the warming El Nino climate phenomenon expected to return in the second half of 2026.

Most of the residents surveyed



Lee Kuan Yew Centre for Innovative Cities research fellow Sarah Chan conducting a survey in 2025 in a one-room flat in Bukit Merah, where Ms Subasheny R. Devan Nair and her grandmother Gandibai Govindasamy live. ST PHOTO: NG SOR LUAN

stated that their outdoor activities and sleep were most affected by the heat, followed by work and study, transport and social activities.

Yet, the surveys also showed that the residents tended to view heat as a condition to be lived with rather than a problem to be actively addressed.

"This is significant and points to a notable normalisation of heat in everyday life," stated the report.

Dr Samuel Chng, head of the Urban Psychology Lab at the same centre in SUTD, noted that most residents are used to living in dis-

comfort, responding only during temperature spikes.

This mindset is not surprising for a tropical city, but it can get dangerous if people do not recognise when heat becomes harmful, especially in terms of cumulative stress, sleep disruption and health effects, said Dr Chng, a co-leader of the research.

The surveys also showed that seniors - who are more vulnerable to rising temperatures - are less likely to feel disturbed by the heat and preferred air-conditioned environments less.

Associate Professor Jason Lee, deputy chair of the human potential translational research programme at NUS Medicine, said that as older people had grown up without air-conditioning, their baseline expectations of comfort are different.

This, however, is a matter of concern, as the body's ability to regulate temperature changes becomes compromised with age.

Seniors may notice heat stress less clearly and delay or avoid cooling measures when needed, pointed out Prof Lee, who is also a co-

lead of the Climate Resilient Citizenry project.

On coping with the heat indoors, electric fans are the most popular, with around 76 per cent of respondents using them. This is followed by opening the windows and adjusting attire. More than half of the respondents turn on the air-conditioning at bedtime, but only around 14 per cent will regularly use it during the day.

To improve airflow at home, the researchers suggested removing clutter and using fans to support cross-ventilation, for example by placing one near a window or door to draw cooler air into the house.

Windows facing strong sunlight can be covered with solar control films to reduce heat gain.

Following the study, the multi-institute team is planning to trial indoor cooling solutions. They are working on a cooling toolkit for homes and a renovation guide to avoid stuffy homes.

Dr Zheng Kai, a lecturer from SUTD's architecture and sustainable design pillar, is exploring how modelling tools can be used to virtually test how ventilation can be improved for different home layouts and window use. This can be useful for housing planners and interior designers.

In another project called Staying Cool, the team will focus on specific interventions for vulnerable groups and residents living in rental units.

Commenting on the Climate Resilient Citizenry project, Professor Petra Tschakert from the NUS geography department noted that while individual responsibility is important, improvements to infrastructure and housing design will make a greater difference.

"It is important to be realistic about the limits of individual action," said the human-environment geographer, who noted that options are constrained for lower-income families, seniors, and those in smaller flats.

She suggested housing retrofits in older flats to improve natural ventilation and comfort, and also called for affordable access to cooling technologies for vulnerable groups.

"The barriers are not primarily about awareness, but about material and infrastructural constraints. This has important implications for how we respond," she said.

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