HABVIA: Heat adaptation benefits for vulnerable groups in Africa

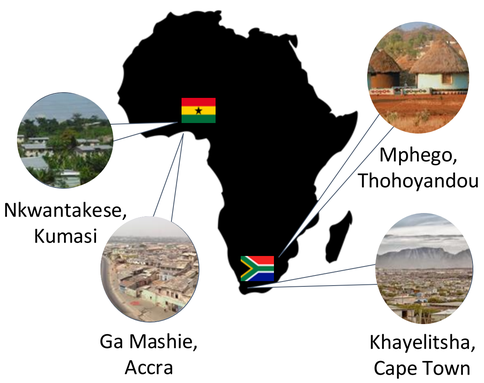
[1] Mark New, [1] Lara Dugas, [1] Michaela Deglon, [2] Thandi Kapwata, [3] Ama de-Graft Aikins, [3] Christopher Gordon, [4] Guy Howard
[1] University of Cape town, [2] South African Medical Research Council, [3] University of Ghana, [4] University of Bristol

Robust evaluation of the environmental, health and socio-economic outcomes of heat adaptations are limited for Africa, especially in real-world settings, despite high vulnerability to heat-related health risk.

Methods

HABVIA is a parallel-group controlled trial conducted in four sites - one urban and one rural low-income community in both Ghana and South Africa. A total of 260 participants (65 per site) are enrolled, with half receiving a cool roof intervention consisting of a highly reflective paint designed to reduce indoor temperatures. Participants complete three non-consecutive clinical visits, followed by six days of continuous physiological monitoring during the hot season, repeated annually over three years. Data collection spans health, socio-economic, and environmental domains.

Study sites



Schedule of intervention and assessments

Timepoint	Year 1 (April 2023 – March 2024)				Year 2 (April 2024 – March 2025)				Year 3 (April 2025 – March 2026)				Year 4 (April 2026 – March 2027)			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Enrolment																
Community engagement	x	x				x	x			x			x		x	x
Participant eligibility screening		x														
Recruitment and informed consent		x	x		x	x										
Intervention																
Intervention workshops						x				x			x			
Intervention eligibility screening						x										
Intervention allocation						x										
Intervention implementation						x	x									
Intervention implementation for controls														x		
Assessments																
Anthropometric measurement			x	x			x	x			x	x				
BIA measurement			x				x				x					
Blood pressure measurement			x	x			x	x			x	x				
CBT measurement			x	x			x	x			x	x				
Glucose measurement			x	x			x	x			x	x				
Physical activity measurement			x	x			x	x			x	x				
Sleep measurement			x	x			x	x			x	x				
Hydration measurement			x	x			x	x			x	x				
Kidney function measurement			x	x			x	x			x	x				
CES-D			x				x				x					
Drinking behaviour			x	x			x	x			x	x				
PANAS			x	x			x	x			x	x				
GPAQ			x				x				x					
PSQI			x	x			x	x			x	x				
ESS			x	x			x	x			x	x				
Thermal comfort measurement			x	x			x	x			x	x				
Air temperature measurement			x	x	x	x	x	x	x	x	x	x				
Relative humidity measurement			x	x	x	x	x	x	x	x	x	x				
Evaluation																
Focus Group Discussions									x	x						
Data analysis													x	x		
Write up and dissemination of results														x	x	
Study close-out																x

Reflective paint intervention

Results

Analysis of diurnal internal temperature and humidity profiles indicates that conditions frequently exceed nationally defined thermal comfort thresholds (23-26 °C, and 19-25 °C for Ghana and SA, respectively). In both Ghana sites, indoor temperatures remained above the comfort zone 100% of the time, including during nocturnal periods. In Mphego, 89.5% of recorded temperatures were above the threshold, while in Khayelitsha, indoor temperatures exceeded the comfort zone 41% of the time during the hot season.

In a sub-analysis of N=30 intervention houses in Khayelitsha, comparison of diurnal temperature patterns between the baseline measurement period and the post-intervention hot season indicates initial efficacy of the reflective paint in reducing indoor heat. In formal brick houses, peak daytime temperatures were reduced by 3–4 °C, while in informal shack dwellings the reduction was greater at 6–7 °C during the hottest hours. In addition to these cooling effects, a delay in peak indoor warming was observed, suggesting improved thermal buffering.

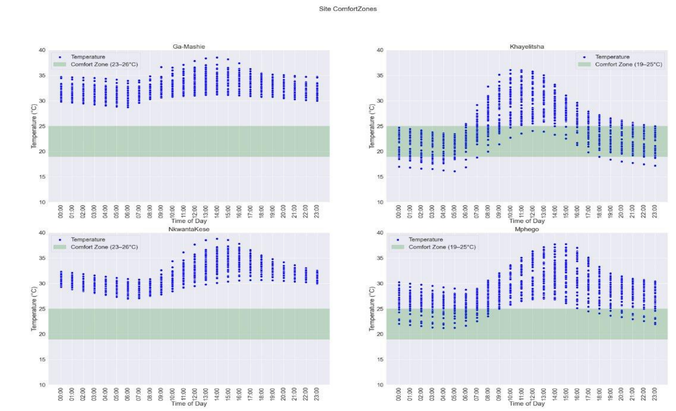


Figure 1. Indoor temperature profiles relative to the nationally determined thermal comfort zone for all sites

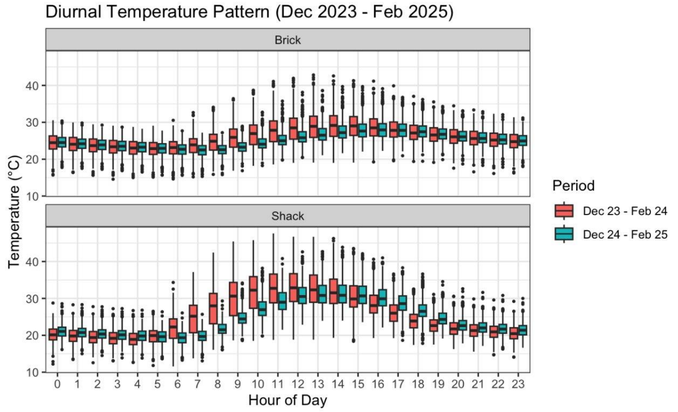


Figure 2. Diurnal indoor temperature patterns for two housing types in Khayelitsha during the baseline and intervention periods

Discussion

Although full analysis is ongoing, early findings demonstrate meaningful variation in indoor thermal conditions and physiological responses, reinforcing the importance of tailored passive cooling solutions. This work exemplifies an adaptive and context-specific approach to sustainable urban health in a warming climate and offers timely insights into scalable, community-based interventions that can support climate resilience in resource-constrained settings.

This project is funded by the Wellcome Trust (226756/Z/22/Z).