
FORTHCOMING INNOVATIVE HEAT- AND SMOKE-SAFE HOMES INITIATIVE: A WOMEN- AND YOUTH-LED CLIMATE–HEALTH ADAPTATION INITIATIVE IN MALAWI

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ABSTRACT

Aims: To evaluate a community-led package training, behaviour change, and passive ventilation retrofits for reducing household heat and smoke exposures and strengthening climate–health capacity in Lilongwe District, Malawi. **Study Design:** Implementation study with pre/post household monitoring and participatory learning cycles, aligned to Malawi’s community health system. **Place and Duration of Study:** Lilongwe District, Malawi; 12-month programme. **Methodology:** Community Health Workers (HSAs), Mother Groups, and Youth Associations will receive a Climate–Health curriculum. Youth artisans will install low-cost passive vents; women leaders will reinforce smoke-safe and heat-safe behaviours through home visits. Indoor PM_{2.5} and temperature will be tracked before and after retrofits in intervention and comparison homes; monthly Climate–Health Sentinel Reports will be used to inform district reviews.

KEYWORDS: Climate change; household air pollution; extreme heat; Malawi; community health; ventilation; youth; women; adaptation.

1.0 INTRODUCTION

Malawi faces intensifying climate variability, including heatwaves, droughts, floods, and cyclones, which disrupt health services and increase the risk of climate-sensitive diseases (IPCC, 2022; DCCMS, 2023). Women and young children experience disproportionate exposure to household air pollution and indoor heat due to reliance on biomass fuels and poorly ventilated cooking spaces (WHO, 2025; MECS, 2020). An integrated, household-level adaptation that combines ventilation, behaviour change and community-owned monitoring is

needed to deliver real-world exposure reductions and durable capacity within existing community health structures (HSAs, Mother Groups, Youth Associations) (Ministry of Health, 2017; Ministry of Health, 2024).

2.0 METHODOLOGY

2.1 Study Setting and Participants

The programme operates in Lilongwe District, Malawi, working through HSAs, Mother Groups, Youth Associations, and Village Health Committees. High-risk households (e.g., pregnant women, children under 5, enclosed kitchens, metal roofs, open-fire cooking) are prioritized through community mapping.

2.2 Intervention Components

(i) A Climate–Health curriculum for HSAs, women leaders, and youth; (ii) youth-led installation of low-cost passive vents and high-level roof openings fabricated from local materials; and (iii) women-led reinforcement of smoke-safe and heat-safe behaviours (fuel drying, pot-lid use, child distancing, hydration, shading, task-shifting).

2.3 Theoretical Framework

A socio-ecological model and participatory action research approach underpin the intervention. Mechanistically, exposure reduction follows a ‘risk-of-exposure’ pathway (source control, airflow/ventilation, time-activity/proximity), while sustained practice is supported by COM-B (capability, opportunity, motivation) reinforced via coaching and peer norms. Embedding these within HSAs and local committees enables institutionalization and scale-up.

2.4 Monitoring and Learning

Low-cost sensors will track PM_{2.5} and indoor temperature pre- and post-retrofit in intervention and comparison homes. Monthly Climate–Health Sentinel Reports will summarize trends in exposure and self-reported symptoms (cough, wheeze, eye irritation, dehydration). Quarterly forums with communities and district officials will support adaptive learning.

3. Expected Results

It is expected that retrofitted homes will show reductions in cooking-period PM_{2.5} and reductions in peak indoor temperatures during cooking, with fewer reported respiratory and

heat-stress symptoms among caregivers. The targeted reductions in cooking-period PM_{2.5} and peak indoor temperatures are expected to exceed 20%.

Frontline actors will gain skills in ventilation and climate-health communication. Over 70% of sensitized households will adopt smoke-safe practices, including structural ventilation modifications, heat alerts, and coaching. It is expected that the results will be consistent with regional evidence that stove-only programmes rarely achieve health gains without substantial exposure reduction through ventilation and behaviour change (Mortimer et al., 2017; Rylance et al., 2019; WHO, 2021). The results will be used to revise Malawi's National Community Health Policies (Ministry of Health, 2024).

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Competing Interests

The authors declare no competing interests.

Authors' Contributions

BFK reviewed and approved the final manuscript.

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Ethical Approval and Consent

Not applicable; this work reports programmatic quality improvement without collection of personally identifiable data. Community consent for monitoring and home visits will be obtained through existing committee structures.

Data Availability

All data underlying the results will be available from the corresponding author upon reasonable request.

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