Healthy Homes: Evaluating the indoor environment, health, carbon emission, economic outcomes of retrofitting social housing properties to improve energy efficiency in a low-income multi-ethnic population

NIHR Public Health Research Programme
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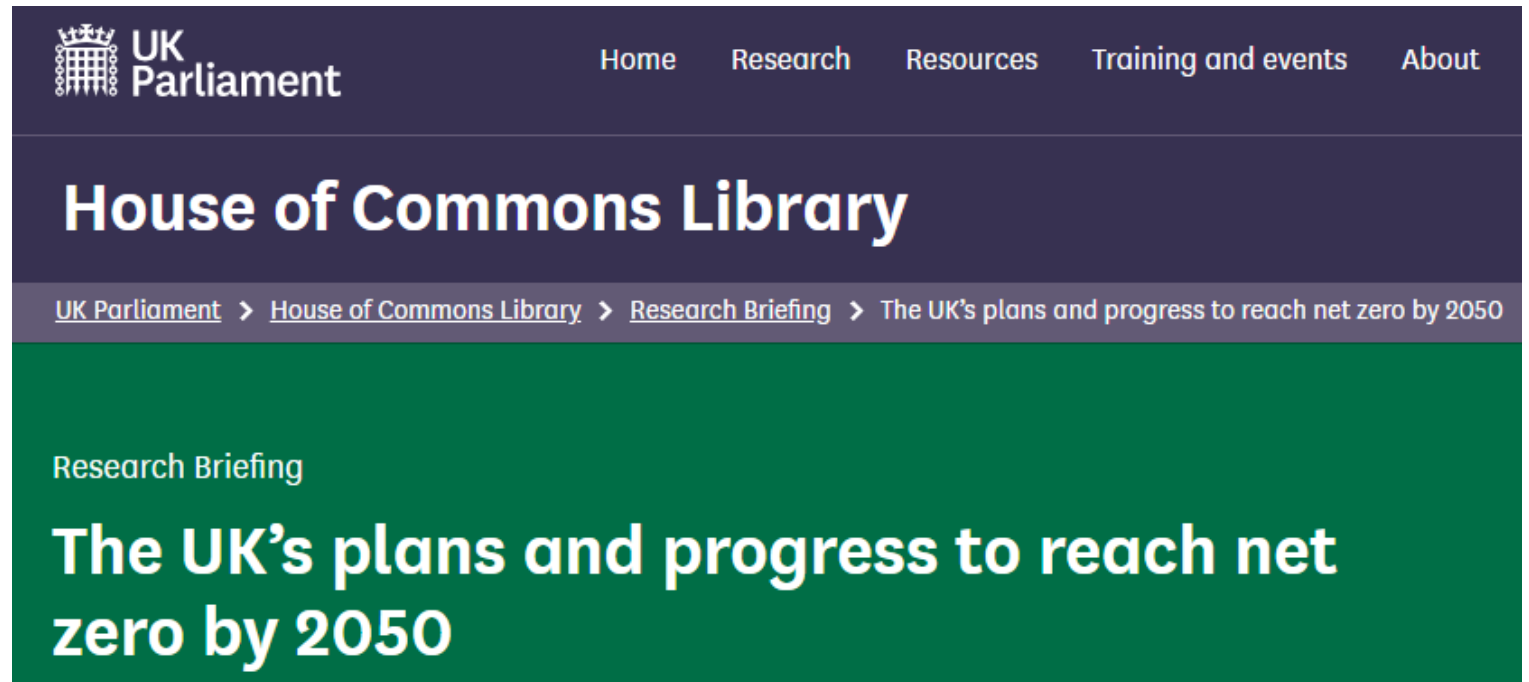# Born in Bradford – an applied research programme

Understand how to keep families happy and healthy

- 3 birth cohorts

- Connected Bradford data infrastructure

- Range of research on:
  - Growth, obesity, physical activity
  - Mental health
  - Health inequalities
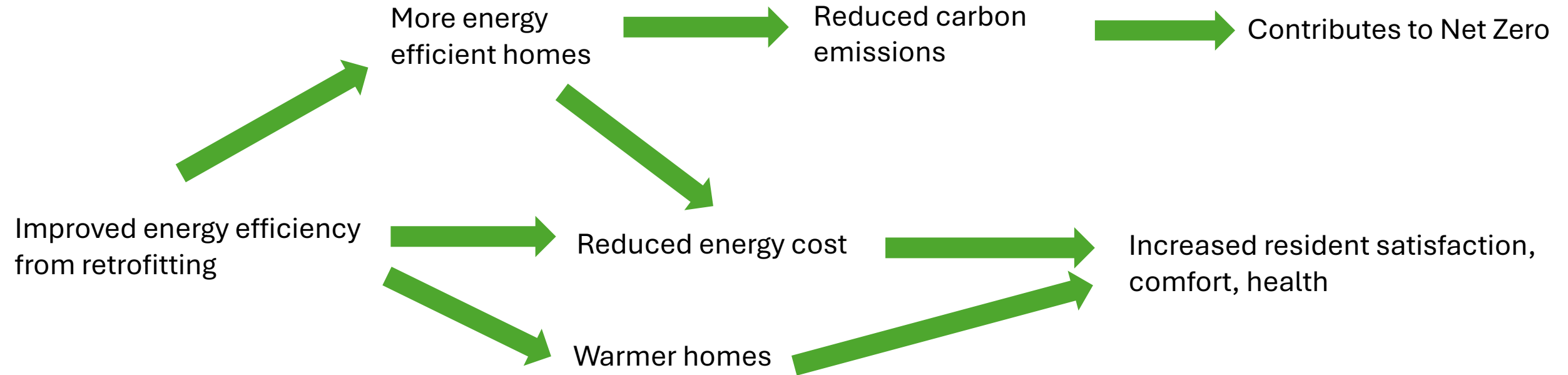 - Environment
  - Evaluation
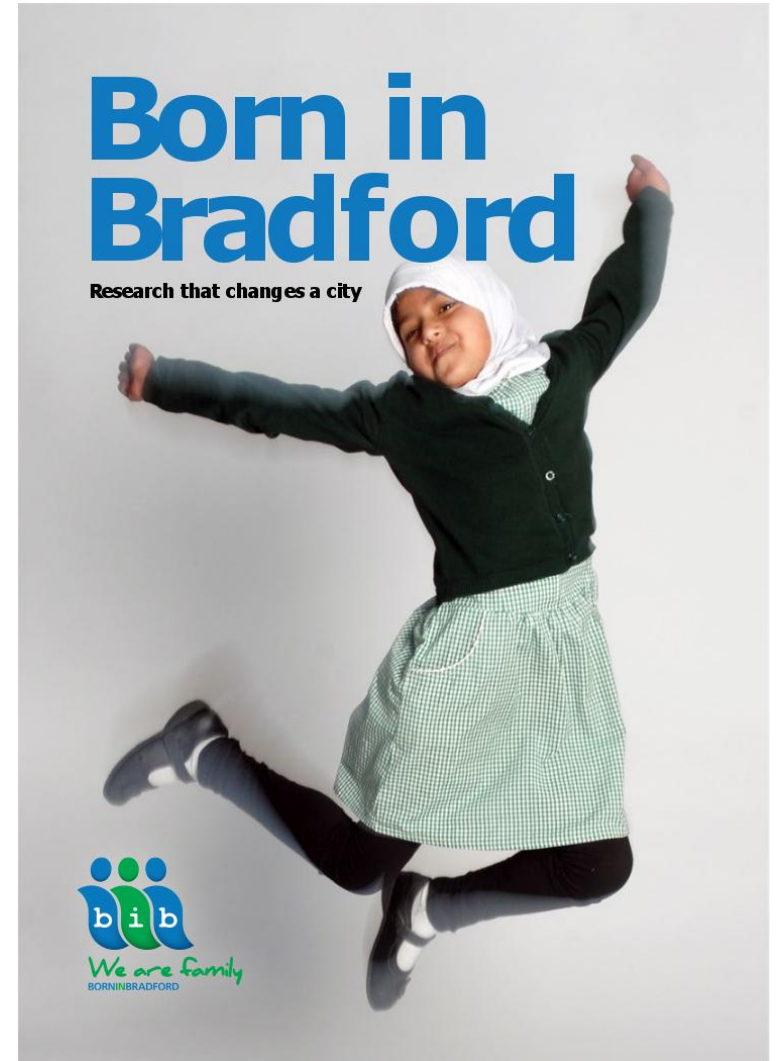
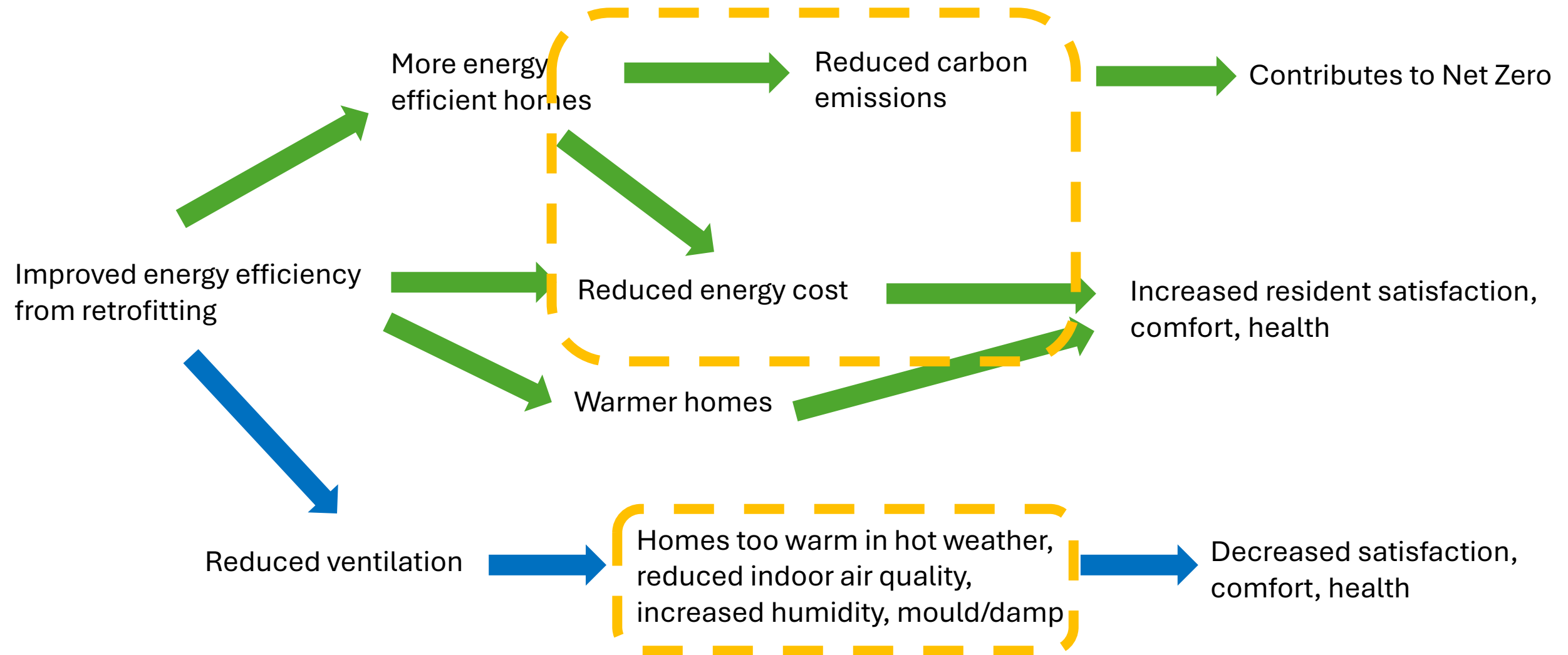# Background to Healthy Homes

- Climate change, Net Zero targets

- Housing ~ 20% of UK carbon emissions

- Retrofit housing stock to meet a minimum EPC C

- Housing is an important determinant of health and wellbeing

Retrofitting - positives

Improved energy efficiency from retrofitting → More energy efficient homes → Reduced carbon emissions → Contributes to Net Zero

More energy efficient homes → Reduced energy cost

Improved energy efficiency from retrofitting → Reduced energy cost → Increased resident satisfaction, comfort, health

Improved energy efficiency from retrofitting → Warmer homes → Increased resident satisfaction, comfort, health

Retrofitting - unknowns

The opportunity – social housing retrofit

- 41% of Incommunities homes (~22,000) below EPC C

- Rolling retrofit program to bring all homes to EPC C by 2030
  - Currently in a 3-year program 25/26, 26/27, 26/28

- Retrofits may include improving or installing insulation (loft, cavity, wall), window and door replacement, improving heating efficiency

Before (A) and after (B) illustration of external wall retrofitting with a white render finish, applied on top of thermal insulation boards. Image credit: Incommunities

Bradford

- 5th largest local authority in England
- 57% White British, 25% of Pakistani origin
- 13th most deprived local authority in England
- Social rented homes make up 15% of housing stock
- 20% of residents living in fuel poverty
- Higher than average rates of ill health

Healthy Homes – what we are doing

4 parts in Healthy Homes:

1. What happens to the indoor environment, energy use, and on resident self-reported health from retrofitting social housing for energy efficiency? Are there trade-offs? [bespoke data collection]

2. How does health and healthcare use change over a longer period? [linked housing and health data]

3. What are the short- and long-term impacts on indoor environmental conditions and carbon emissions, and health and economic impacts? [using data from WP1]

4. How was the retrofit implemented, what wider contextual factors may have influenced it? [resident and stakeholder interviews, peer-led participatory inquiry, systems mapping workshops]

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Healthy Homes – what we are doing

210 homes to be retrofitted between March-October 2026 (intervention homes) and 210 homes to be retrofitted after March 2027 (control homes)
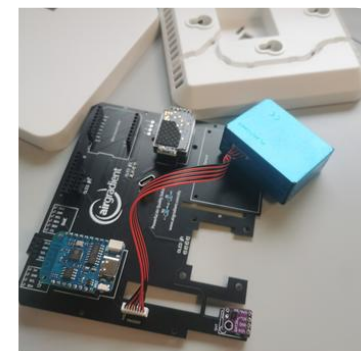
- Eligible if homes EPC < C

Primary outcome: temperature (AirGradient)

Secondary outcomes:

- Relative humidity (AirGradient)
- Indoor air quality – $PM_{2.5}$, NO_2, CO_2 (AirGradient)
- Estimated air changes – CO_2 (AirGradient)
- Mould risk (monitored & modelled)
- Energy use/carbon footprint (meter readings)
- Take-back factor (energy meter readings + temperature)
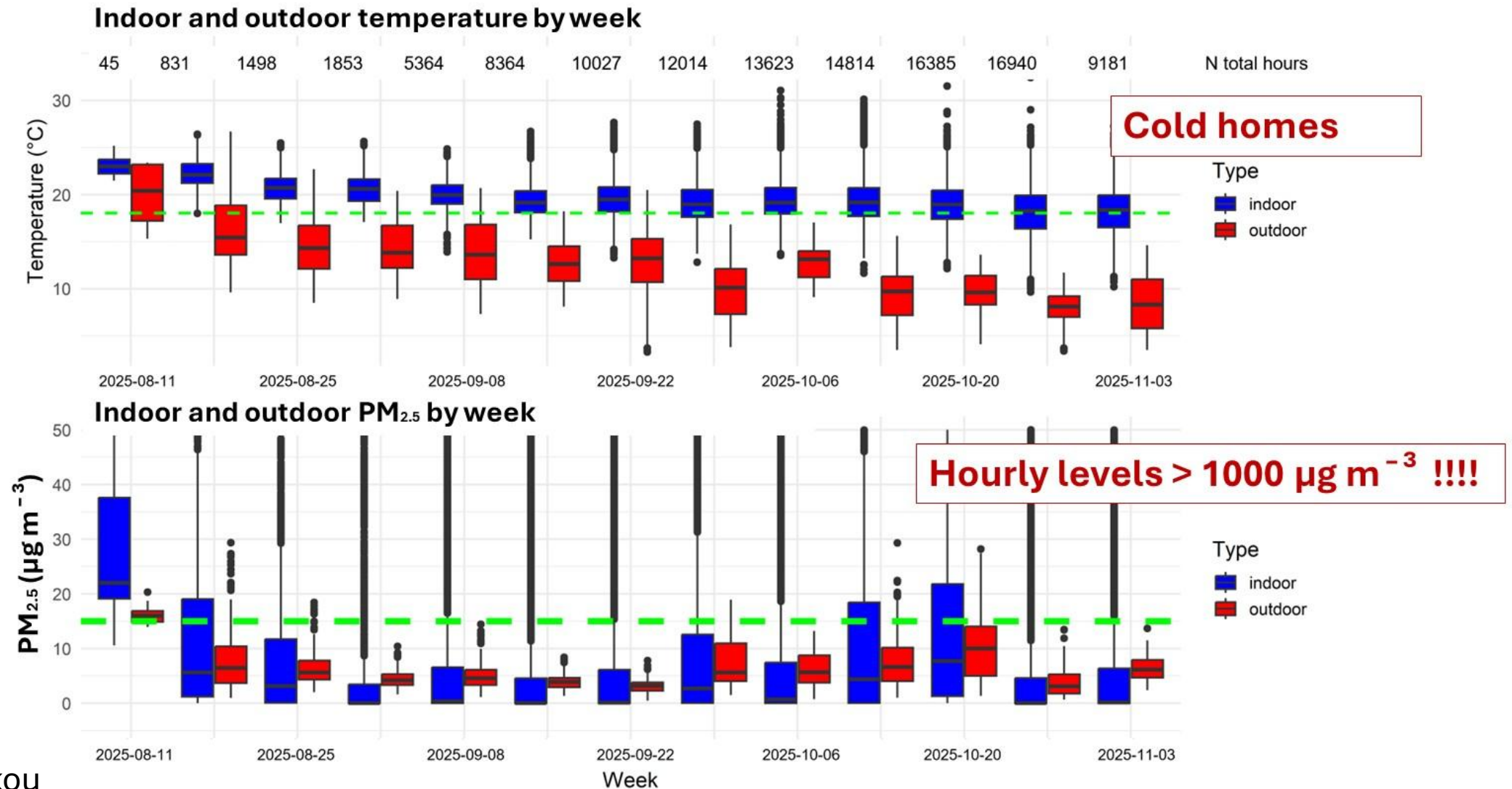- Resident thermal comfort, respiratory & mental health (questionnaires)

Sensor (outside)

Sensor (inside)

Early data - AirGradient

Preliminary results from deployment

Indoor and outdoor temperature by week

Indoor and outdoor PM₂.₅ by week

Cold homes

Hourly levels > 1000 μg m⁻³ !!!!

Lia Chatzidiakou

- Currently in the process recruitment and AirGradient deployment

- Coming up: meter readings, winter questionnaire, mold sensor, resident interviews, peer research recruitment and projects

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To find out more about BiB and Healthy Homes