ClimaCare: Overheating in care homes

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Met Office

UK Research and Innovation

UK CLIMATE RESILIENCE PROGRAMME

London School of Hygiene & Tropical Medicine

CIBSE Chartered Institution of Building Services Engineers (CIBSE)

Ministry of Housing, Communities and Local Government (MHCLG)

Care Quality Commission (CQC)

PRP Architects


Aston House care home

Greater London Authority (GLA)

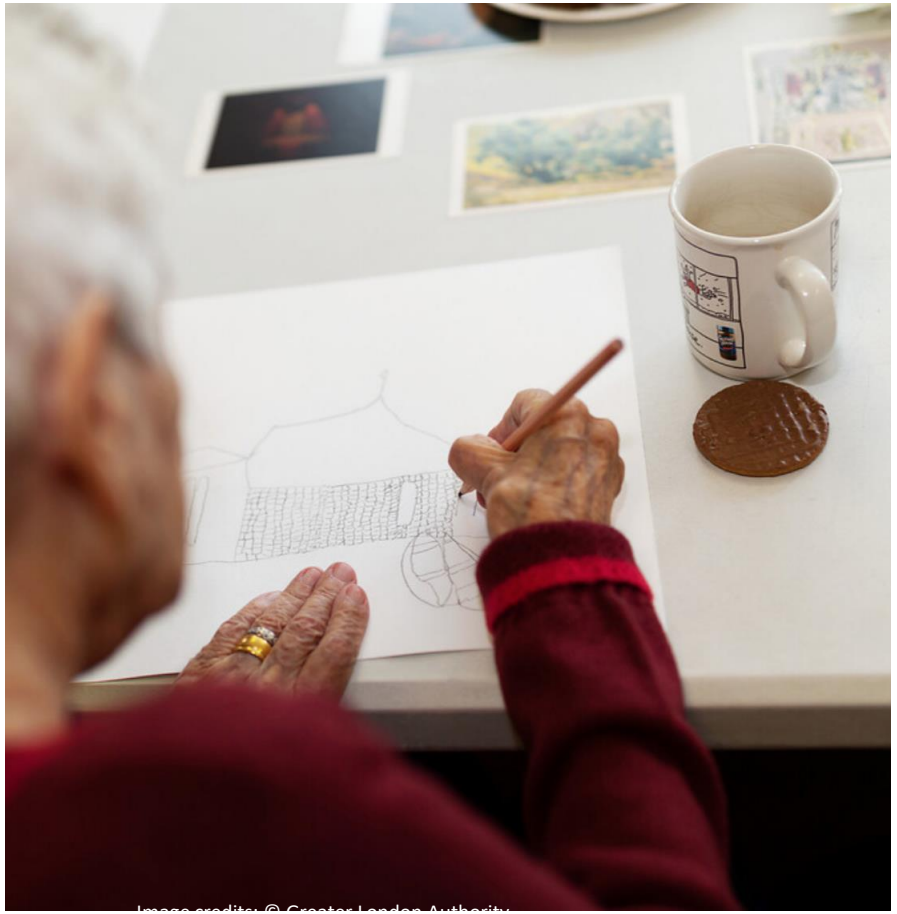
Public Health England (PHE)

Oxford Brookes University

UCL

Presentation outline

- Project overview
- Systems thinking
- Environmental monitoring
- Physiological monitoring
- Dynamic thermal modelling
- Cost-benefit analysis
- Project output



Overview

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Overarching aim and objectives

Quantify climate related heat risks in care provision at the national level, and enhance our understanding of individual behaviours, organisational capacity and governance to enable the UK's care provision to develop equitable adaptation pathways

1. Undertake longitudinal monitoring in 50 UK care settings	**2.** Study in more detail a sub-sample of 25 care settings	**3.** Assess the impact of heat exposure on the health of residents in a sub-sample	**4.** Apply established modelling methods to develop a building stock model of the UK's care provision	**5.** Expand stakeholder community that was built during the pilot project to further explore organisational capacity and structures, and how these influence action and policy, and to generate best practice guidance for practitioners

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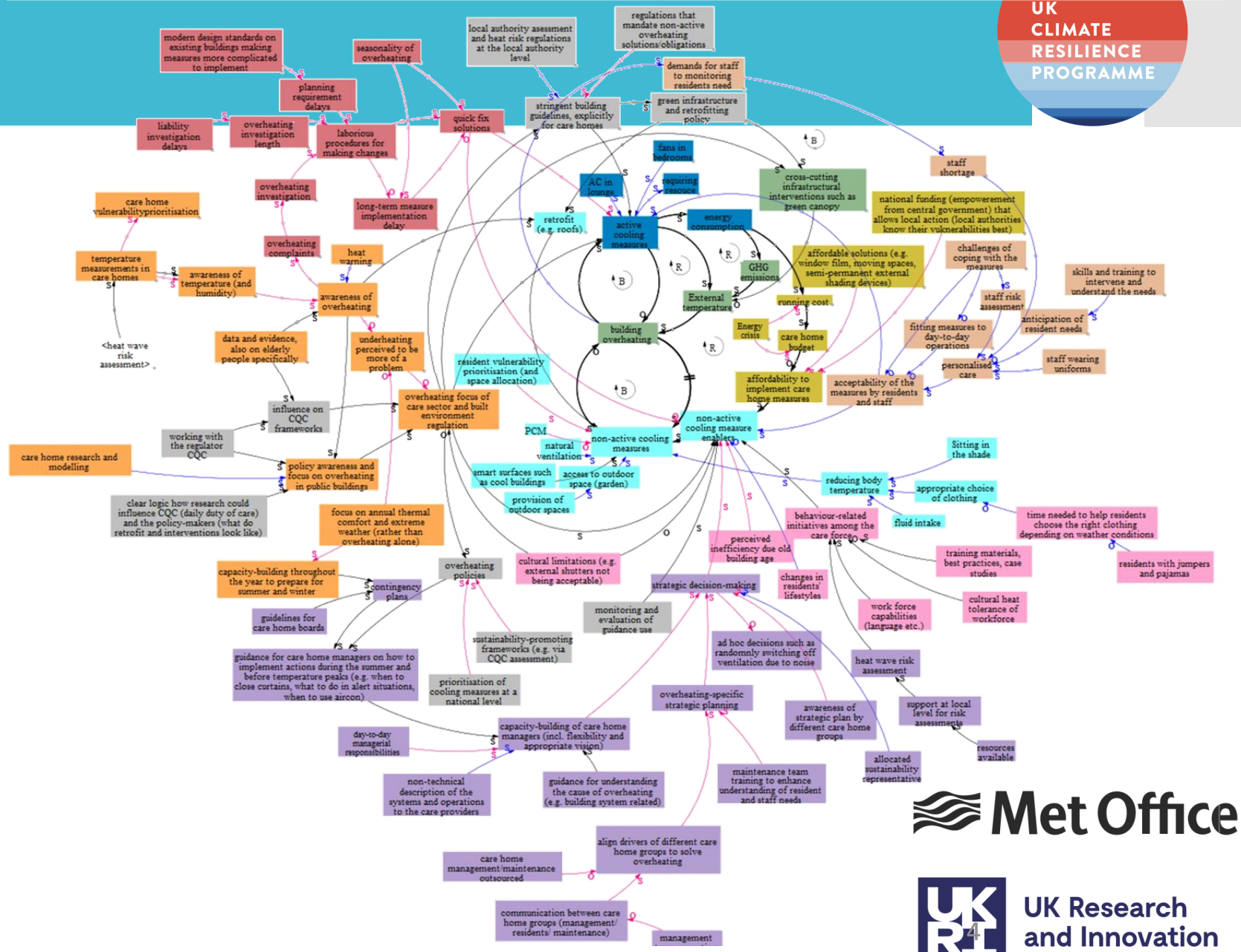
Systems thinking

Participatory workshop output: Understanding the underlying system structure of the problem



CLIMATE

ACTIVE COOLING

NON-ACTIVE COOLING

AFFORDABILITY

ACCEPTABILITY

OVERHEATING AWARENESS

QUIICK FIX ENABLERS

BEHAVIOURAL/CULTURAL ASPECTS

CARE HOME GOVERNANCE

POLICY & GUIDELINES

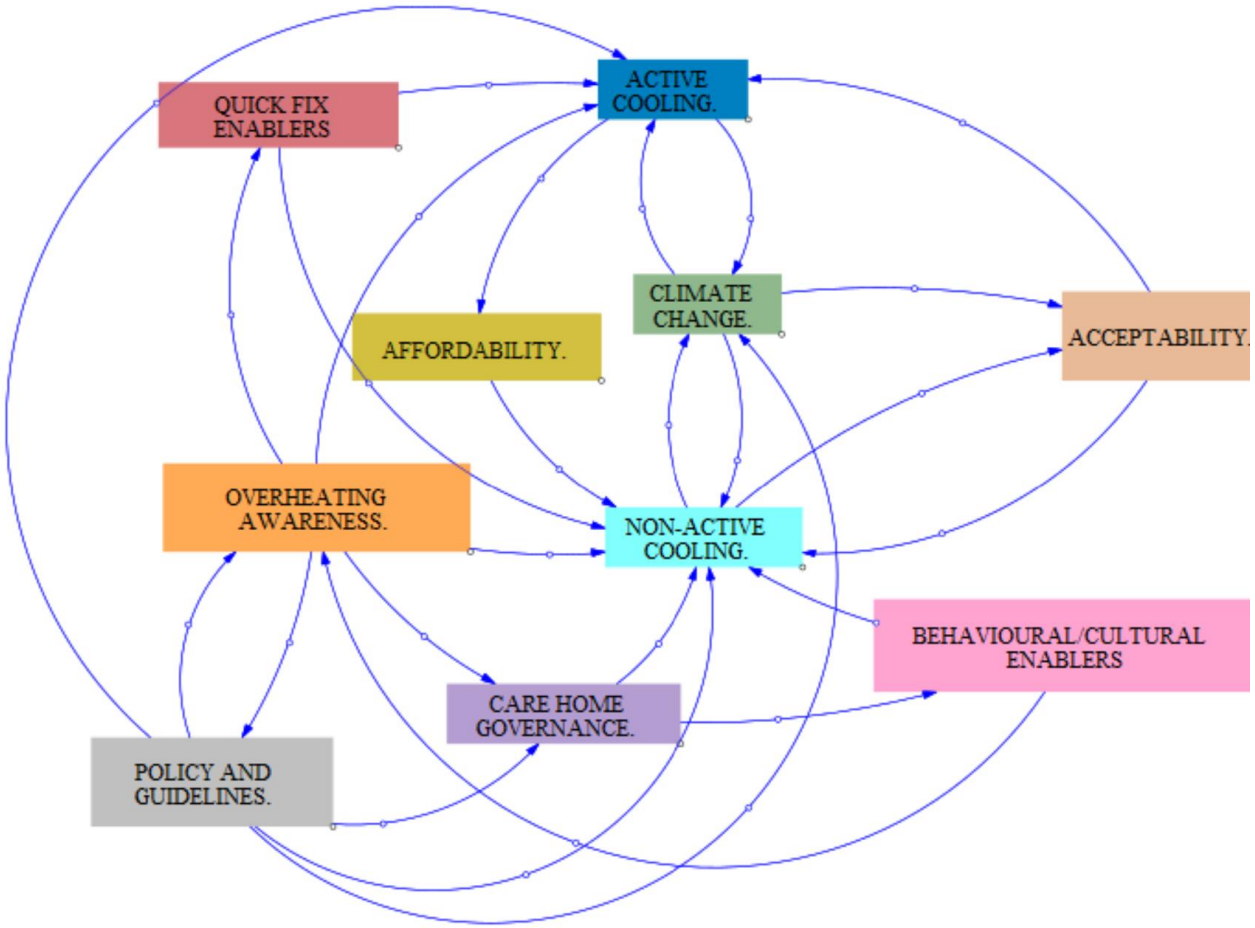
Systems thinking

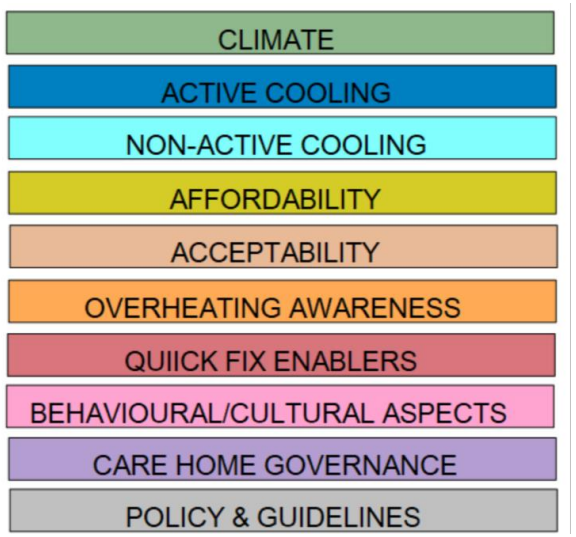
1) Develop academic publications to report on findings so far.

2) Perform further analysis, to identify external influencing parameters and leverage points.

3) Organise a follow-up workshop.

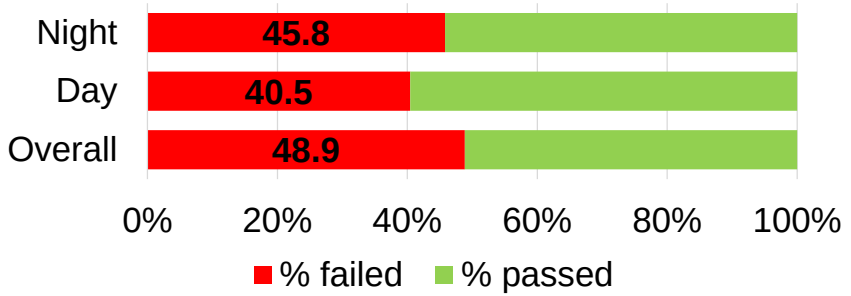
4) Issue a set of recommendations per stakeholder group.





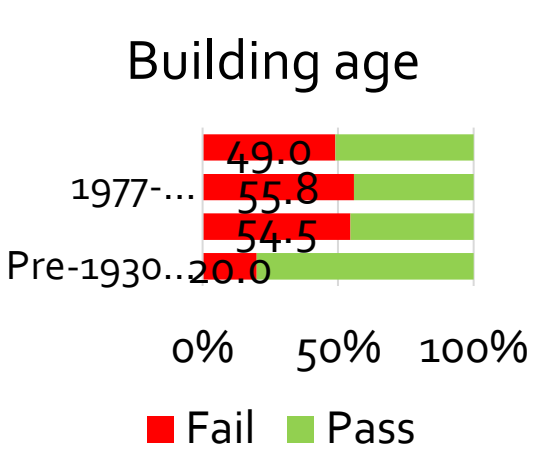
Environmental monitoring: recruitment

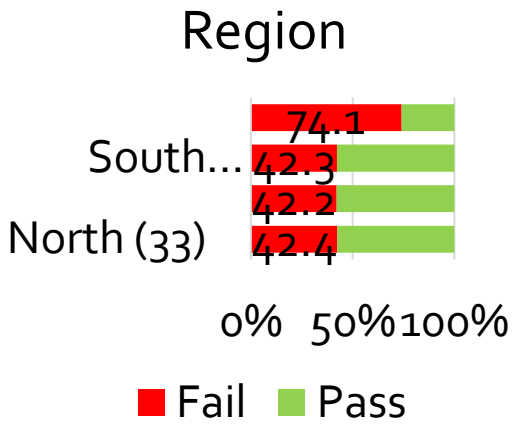
- Currently engaged with **47 care homes**:
  - 10 in London
  - 10 in the south
  - 15 in the midlands
  - 12 in the north.
- Almost half of the 131 bedrooms monitored were found to be overheated.
- Criterion A (dynamic threshold temperature) failed in 21% of bedrooms.
- Criterion B (26 °C threshold temperature - night time hours) failed in 60% of bedrooms.
- Criterion C (26 °C threshold temperature - all occupied hours) failed in 63% of bedrooms.

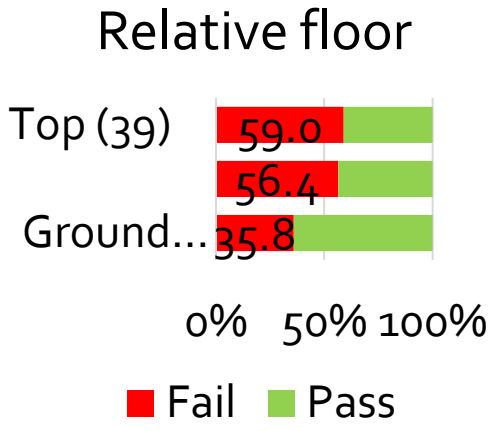


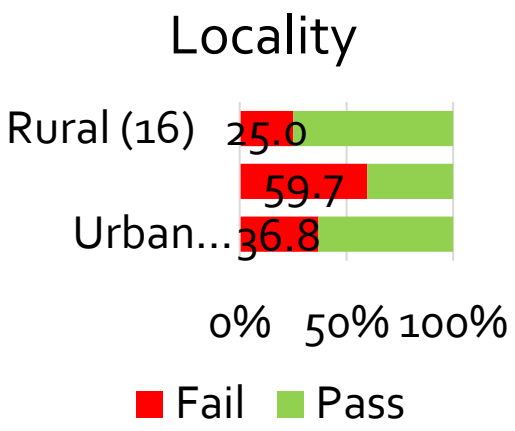
Environmental monitoring: key findings

- Pre-1930 bedrooms less likely to be overheating compared with those built post-1930.
- Bedrooms outside of London much less likely to be overheating than those in London.
- Ground floor bedrooms less likely to be overheating compared with those above them.
- Only a **quarter** of rural bedrooms overheating, compared to **more than a third** of urban bedrooms and **three fifths** of suburban bedrooms.









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Physiological monitoring

Some form of physiological monitoring planned for summer 2023 (subject to ethics approval).

- Heart rate monitoring
- Body surface temperature
- Hourly activity diary
- ~10 simultaneous measures x 2 times (hot v control day) x 3 care homes (TBD)
- Comparison within the same person (hot v control day)
- Comparison with monitored building room temperature

Dynamic thermal monitoring

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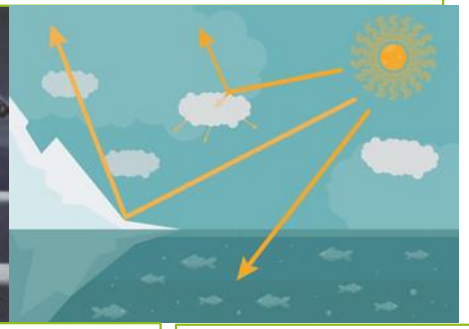
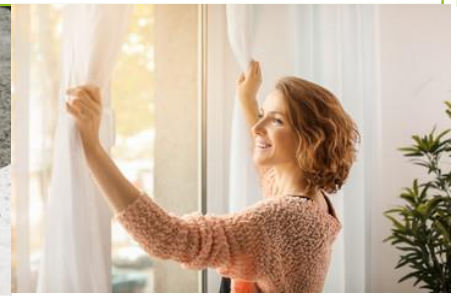
1. Minimising internal heat generation

2. Keeping the heat out



3. Managing heat

3. Passive ventilation methods



4. Active cooling

Combined measures

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Dynamic thermal modelling: key findings to date

- Results show **high overheating exposures** for all modelled care homes.
- Care home **building construction age** may plan a critical role in overheating; staff and residents in older, heavyweight buildings are less likely to overheat in the summer.
- **Night ventilation** emerged as the single most impactful measure across all building types.
- Effective combination measures vary depending on insulation and thermal mass levels

New and high-insulated buildings may benefit more from external shading and higher ventilation rates.

Older buildings with higher heat loss and thermal mass capacity may benefit more from the application of high-albedo materials.

Cost-Benefit Analysis (CBA) work

- **External window shading** was estimated to reduce mean indoor temperatures by 0.9 °C in a 'warm' summer and 0.6 °C in an 'average' summer.
- In a care home of 50 residents, the **heat deaths** and '**years of life lost**' averted by such shading were estimated under three life-expectancy assumptions:

	Method 1	**Method 2**	**Method 3**
'warm' summer			
Heat deaths averted	0.07	0.47	0.28
Years of life lost averted	0.29	0.76	0.14
'average' summer			
Heat deaths averted	0.05	0.31	0.19
Years of life lost averted	0.20	0.51	0.10

- Over a 20-year time horizon and assuming an annual discount rate of 3.5%, the **monetised benefit of reduced 'years of life lost'** would be around £90,000, £230,000 and £44,000 under the three life expectancy assumptions.
- It appears that **modest cost adaptations** to heat risk may be justified in conventional cost-benefit terms even under conservative assumptions about life expectancy.

Project output & policy implications

- Journal/conference papers
- CCRA3
- Collaboration with the Epilepsy Society
- Showcasing project in COP26 and other events
- CIBSE Research Insights / follow on technical memorandum?
- GLA reports
- UKHSA collaboration
- DHSC tailored policy briefings
- Input to CCC progress reports

Project output: academic publications

- Christopher Razo, Mike Davies, Rajat Gupta, Eleni Oikonomou, Alastair Howard, Nishesh Jain, Anna Mavrogianni, Ioanna Tsoulou. "Passive strategies to improve thermal comfort in a care home in London, UK". *In ASHRAE Conference,* 2023.
- Rajat Gupta. "*Do old people only feel the cold?" Summertime overheating in UK Care homes,* Keynote, Comfort at the Extremes (CATE) 2021 Conference (Online), 24-26 October 2021, Sultan Qaboos University, Muscat, Oman.Anna Mavrogianni, Eleni Oikonomou, Ioanna Tsoulou, Giorgos Petrou, Mike Davies, Alastair Howard, Rajat Gupta, Ai Milojevic, Paul Wilkinson (2021) "Indoor overheating, climate resilience and adaptation of care settings". The Palgrave Handbook of Climate Resilience Societies
- Rajat Gupta, Alastair Howard, Mike Davies, Anna Mavrogianni, Ioanna Tsoulou, Eleni Oikonomou, Paul Wilkinson (2021) "Examining the magnitude and perception of summertime overheating in London care homes". Building Serv. Eng. Res. Technol., 1-23, DOI: 101177/01436244211013645
- Ioanna Tsoulou, Giorgos Petrou, Nishesh Jain, Eleni Oikonomou, Anna Mavrogianni, Rajat Gupta, Ai Milojevic, Alastair Howard, Paul Wilkinson, and Mike Davies. “Assessing the Current and Future Risk of Overheating in London's Care Homes: The Effect of Passive Ventilation.” In *Building Simulation 2021 Conference*, 2021.
- Andrew Ibbetson, Ai Milojevic, Anna Mavrogianni, Eleni Oikonomou, Nishesh Jain, Ioanna Tsoulou, Giorgos Petrou, Rajat Gupta, Michael Davies, Paul Wilkinson (2021) "Mortality benefit of building adaptations to protect care home residents against heat risks in the context of uncertainty over loss of like expectancy from heat". Climate Risk Management
- Rajat Gupta, Alastair Howard, Mike Davies, Anna Mavrogianni, Ioanna Tsoulou, Nishesh Jain, Eleni Oikonomou, Paul Wilkinson (2021) "Monitoring and modelling the risk of summertime overheating and passive solutions to avoid active cooling in London care homes". Energy and Buildings
- Eleni Oikonomou, Anna Mavrogianni, Nishesh Jain, Rajat Gupta, Paul Wilkinson, Alastair Howard, Ai Milojevic, and Mike Davies. “Assessing Heat Vulnerability in London Care Settings: Case Studies of Adaptation to Climate Change.” In *5th Building Simulation and Optimisation Virtual Conference*, 2020. http://www.ibpsa.org/proceedings/BSO2020/BSOV2020_Oikonomou.pdf.
- Rajat Gupta, and Alastair Howard. “Summertime Indoor Temperatures and Thermal Comfort in Nursing Care Homes in London.” In *11th Windsor Conference Resilient Comfort*, 2020. https://windsorconference.com/wp-content/uploads/2020/05/WC2020_Proceedings_small.pdf.
- Rajat Gupta and Alastair Howard. “Monitoring the risk of summertime overheating in modern and older care settings in London.” In *CIBSE ASHRAE Technical Symposium*, Glasgow, 16-17 April 2020.

Project output: planned publications

Title	Type	Status
Passive strategies to improve thermal comfort in a care home in London	ASHRAE conference paper	Submitted
Adapting care homes to heat: a comparison of building interventions on three London care homes	Journal paper	In preparation
Cost-benefit analysis of interventions to protect against heat risks to residents of care homes in England	Journal paper	In preparation
Modelling summertime overheating and air quality trade-offs due to natural ventilation in London care homes	Journal paper	In preparation
Passive building adaptations to improve temperature and humidity conditions in a care home in London	Journal paper	In preparation
Guidelines and regulations for the resilience of care provision to rising temperature: Findings from a participatory design stakeholder workshop	Ecocity Summit / Journal paper	In preparation
Cost-benefit variation of care home overheating reduction measures with geographical location	Journal paper	Proposed
Cost considerations and technical feasibility of overheating adaptation interventions in UK care homes	Journal paper	Proposed
Human measurements' paper	Journal paper	Proposed

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