Healthcare Adaptation Research: An overview of research projects investigating climate adaptation in healthcare

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Session Outline

- **Past research projects on climate adaptation in healthcare:**
  - Design and Delivery of Robust Hospital Environments in a Changing Climate (DeDeRHECC)
  - Project Climate change resilience framework for health systems and hospitals (LIFE RESYSTAL)

- **Current research projects on climate adaptation in healthcare:**
  - INtegrated SUstainable and REsilient Healthcare Real Estate (INSURE HRE)
  - National Research Hub on Net Zero, Health and Extreme Heat (HEARTH)

- **Future research projects on climate adaptation in healthcare:**
  - NIHR - Climate Change and Health: Adapting Health and Social Care Systems - Development Awards
  - NIHR - The impact of local climate change adaptation on health and health inequalities.

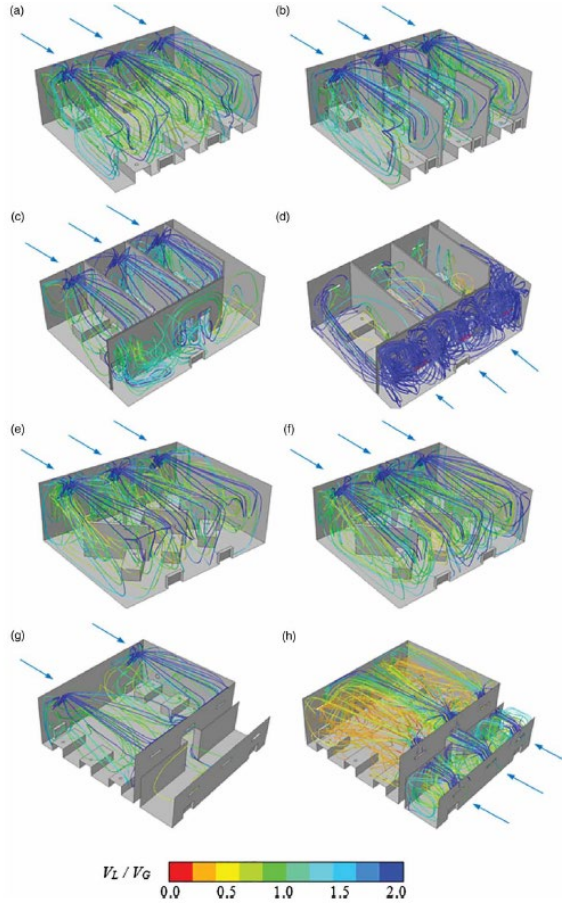
Past research projects on climate adaptation in healthcare

DeDeRHECC

'Design and Delivery of Robust Hospital Environments in a Changing Climate' (DeDeRHECC)

- Funded by: Engineering and Physical Sciences Research Council
- Time frame: 2009-2012.

- Project aim: The 'Design and Delivery of Robust Hospital Environments in a Changing Climate' (DeDeRHECC) project is investigating the design and delivery of economical and practical strategies for the adaptation of the NHS Retained Estate to increase its resilience to climate change whilst meeting the onerous carbon reduction targets set for the NHS.



C. Alan Short, Catherine J. Noakes, Carl A. Gilkeson & Alistair Fair (2014). Functional recovery of a resilient hospital type, Building Research & Information, 42:6, 657-684, DOI: https://doi.org/10.1080/09613218.2014.926605

DeDeRHECC - OUTPUTS

De²RHECC
Design and Delivery of Robust Hospital Environments in a Changing Climate

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Building resilience to overheating into 1960's UK hospital buildings within the constraint of the national carbon reduction target: Adaptive strategies

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ABSTRACT

The National Health Service (NHS) Estate in England includes 18.83 Mm² of acute hospital accommodation, distributed across 330 sites. Vulnerability to overheating is clear with 15,000 excess deaths occurring nationally during the July 2003 heatwave. The installation of mechanical cooling in existing hospitals appears to be the inevitable recommendation from NHS patient safety risk assessments but the carbon implications would undermine the NHS Carbon Reduction Strategy. NHS CO_2 emissions constitute 25% of all public sector emissions, equivalent to 3% of the UK total. In the post-2008 economic climate, the likelihood of wholesale replacement of the NHS Estate is significantly diminished; refurbishment is now of increasing interest to the Trusts that together make up the NHS. The research project 'Design and Delivery of Robust Hospital Environments in a Changing Climate' seeks to understand the environmental performance of the current NHS Estate and, from this, to establish its resilience. To this end, hospital buildings operated by four NHS Trusts are being monitored and simulated using dynamic thermal models calibrated against measured data. Adaptive refurbishment options are proposed and their relative performance predicted against the existing internal conditions, energy demands and CO_2 emissions. This paper presents findings relating to one representative type building, a medium-rise ward block dating from the late 1960s. It shows that this particular type may have more resilience in the current climate than might have been expected, that it will remain resilient into the 2030s, and that relatively non-invasive measures would extend and increase its resilience whilst saving energy.

1. Introduction

This paper investigates the resilience of various refurbishment schemes for a typical hospital tower building in the UK to climate change, focussing on summertime overheating. The National Health Service (NHS) Estate (England) comprises 28.38 Mm² of accommodation. In England, there are 330 acute hospital sites with a gross floor area of 18.83 Mm²; 8.3 Mm² is occupied by patients [1]. The NHS is required by law to reduce its carbon emissions [2] and stringent targets for energy demand have been set. The NHS reports that it is currently responsible for 30% of UK total public sector carbon emissions, and 3% of all UK emissions [3]. Its annual carbon footprint, as of 2007, was 21 Mt pa (million tonnes of CO_2) of which 24% can be attributed to building energy [3]. Although energy is being used more efficiently, consumption has risen 40% since 1990 and increased by 2 Mt between 2008 and 2009 [3]. Attempts to reduce consumption in England by 0.15 MtC (million tonnes of carbon) between 2000 and 2010 appear to have failed [4]. According to the Department of Health's 'Health Technical Memorandum 07-02', 44% of the energy used in a typical UK hospital is attributable to air and space heating [5]. 'Health Technical Memorandum 07-07' calls on NHS organisations to achieve targets for delivered energy of 35–55 GJ/100 m² for new buildings and major refurbishments, and 55–65 GJ/100 m² for less intensive refurbishments of existing facilities,[1] for all building uses including space heating, hot water, lights, appliances and catering [6]. Data shows that energy use in English hospitals is often far in excess of these levels [7].

The challenge of reducing CO_2 emissions and energy demand is amplified by the health implications of a changing climate.[2] The NHS is required to provide a safe and comfortable environment for patients and visitors (more than 1 million every 36 h) and staff (1.4

[1] The use of GJ/100 m² relating energy use to volume is customary within the NHS.
[2] The CO_2 and energy reduction aims are often met simultaneously by reducing energy demand. However, since refurbishment may include changes to the method of supplying heat and electricity, meeting the CO_2 ambition may differ from meeting an energy target. For example the use of biomass from sustainable sources reduces emissions but the energy demand, in the form of wood or pellets, may increase as biomass boilers may be relatively inefficient compared to other conversion technology such as combined heat and power plant.

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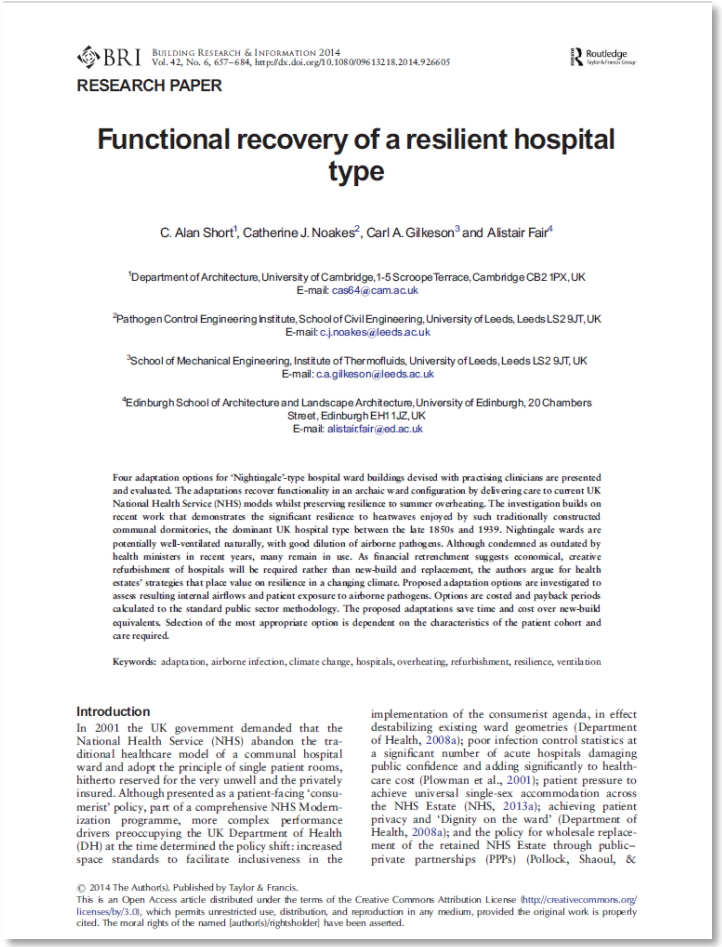

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RESEARCH PAPER

Functional recovery of a resilient hospital type

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Four adaptation options for 'Nightingale'-type hospital ward buildings devised with practising clinicians are presented and evaluated. The adaptations recover functionality in an archaic ward configuration by delivering care to current UK National Health Service (NHS) models whilst preserving resilience to summer overheating. The investigation builds on recent work that demonstrates the significant resilience to heatwaves enjoyed by such traditionally constructed communal dormitories, the dominant UK hospital type between the late 1850s and 1939. Nightingale wards are potentially well-ventilated naturally, with good dilution of airborne pathogens. Although condemned as outdated by health ministers in recent years, many remain in use. As financial retrenchment suggests economical, creative refurbishment of hospitals will be required rather than new-build and replacement, the authors argue for health estates' strategies that place value on resilience in a changing climate. Proposed adaptation options are investigated to assess resulting internal airflows and patient exposure to airborne pathogens. Options are costed and payback periods calculated to the standard public sector methodology. The proposed adaptations save time and cost over new-build equivalents. Selection of the most appropriate option is dependent on the characteristics of the patient cohort and care required.

Keywords: adaptation, airborne infection, climate change, hospitals, overheating, refurbishment, resilience, ventilation

Introduction

In 2001 the UK government demanded that the National Health Service (NHS) abandon the traditional healthcare model of a communal hospital ward and adopt the principle of single patient rooms, hitherto reserved for the very unwell and the privately insured. Although presented as a patient-facing 'consumerist' policy, part of a comprehensive NHS Modernization programme, more complex performance drivers preoccupying the UK Department of Health (DH) at the time determined the policy shift: increased space standards to facilitate inclusiveness in the implementation of the consumerist agenda, in effect destabilizing existing ward geometries (Department of Health, 2008a); poor infection control statistics at a significant number of acute hospitals damaging public confidence and adding significantly to healthcare cost (Plowman et al., 2001); patient pressure to achieve universal single-sex accommodation across the NHS Estate (NHS, 2013a); achieving patient privacy and 'Dignity on the ward' (Department of Health, 2008a); and the policy for wholesale replacement of the retained NHS Estate through public–private partnerships (PPPs) (Pollock, Shaoul, &

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Video & Audio: Robust Hospitals in a Changing Climate: the DeDeRHECC project - Metadata

LIFE RESYSTAL

Project Climate change resilience framework for health systems and hospitals

- Funded by: European Commission (EC)'s LIFE programme
- Time frame: September 2021 - August 2025
- Project aim: LIFE RESYSTAL was a groundbreaking project aiming to ensure that health infrastructures across Europe are prepared for the impacts of climate change. The project worked with seven pilot hospitals and two health systems to ensure we can develop hands-on and universally applicable tools and resources. We engaged stakeholders across the European healthcare sector to make them more robust.

LIFE RESYSTAL - OUTPUTS

[Navigating Climate Resilience: A GPS for Healthcare Systems]

[Transforming healthcare procurement to build climate resilience - Life Resystal]

[Tracking climate adaptation in hospitals: An inventory of structural measures - ScienceDirect]

Current research projects on climate adaptation in healthcare

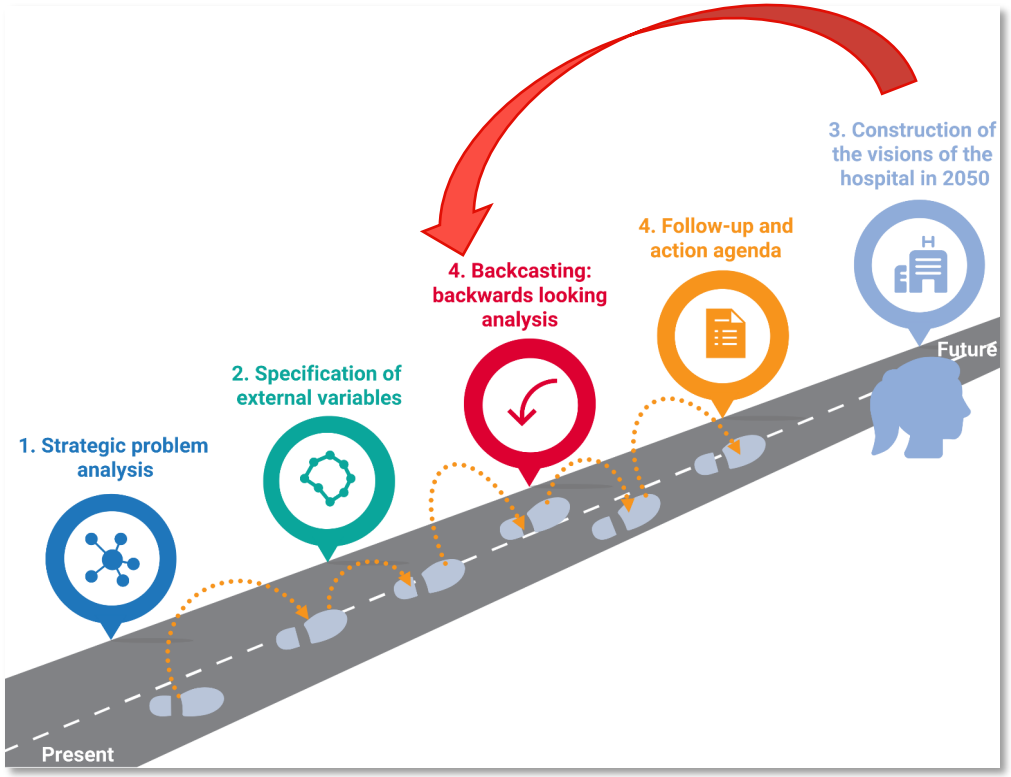
INSURE HRE

INSURE HRE
INtegrated SUstainable and REsilient Healthcare Real Estate

Fellowship project "INtegrated SUstainable and REsilient Healthcare Real Estate" (INSURE HRE)

- Funded by: THIS Institute (The Healthcare Improvement Studies Institute), University of Cambridge.
- Time frame: 2022-2026.

- Project aim: To develop a framework for an INtegrated SUstainable and REsilient Healthcare Real Estate able to provide integrated mitigation strategies to transition to a zero-carbon future by 2050, and adaptation strategies to address existing climate change through better informed facilities and built asset management planning.



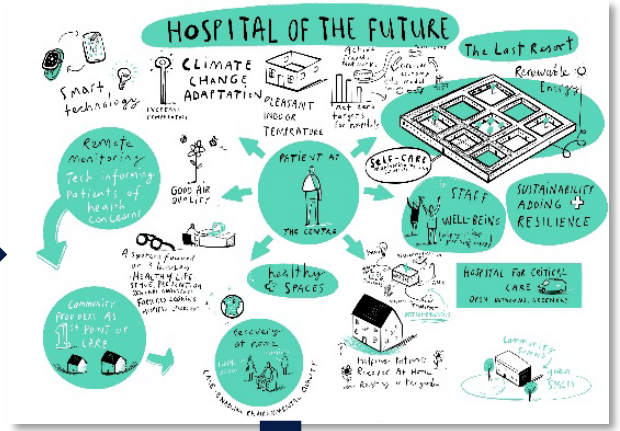
INSURE HRE

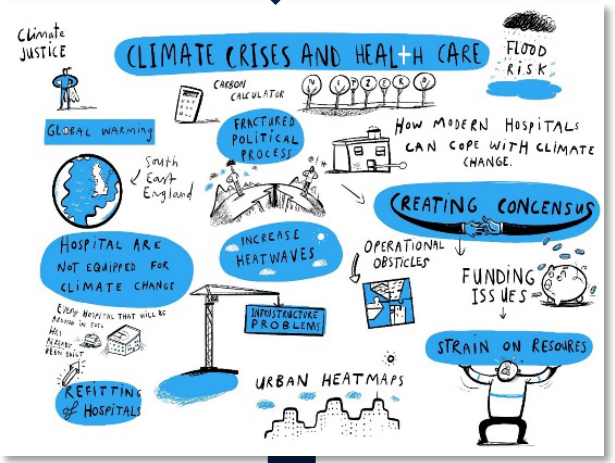
INSURE HRE
INtegrated SUstainable and REsilient Healthcare Real Estate

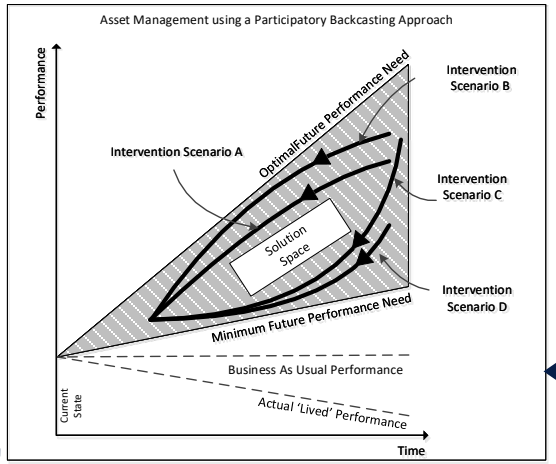
Today's Hospital

Drivers For Change

- Changing healthcare delivery
- Changing user's expectations
- Emerging digital technologies
- Reducing the impact of hospitals on the environment
- Resilience to extreme events







Maintenance and Refurbishment Plans

Built Asset Management Strategy

INSURE HRE - OUTPUTS

INSURE HRE
INtegrated SUstainable and REsilient Healthcare Real Estate

Pascale, F., & Jones, K. (2023). Drivers to achieve future-proofed hospital built assets. The proceedings of the 22nd EuroFM Research Symposium 2023, European Facility Management Network, 09-11 November 2023, Istanbul, Turkey. Drivers to achieve future-proofed hospital built assets.

Pascale, F and Achour, N. (2024). Identifying the driving factors for the future hospital in a climate change scenario. Ajayi, Saheed; Gorse, Chris; Parkinson, Leonie; Pooley, Alison; Booth, Colin; Newport, Darryl; et al. (2024). International Sustainable Ecological Engineering Design for Society (SEEDS) Conference 2024 - Conference Proceedings. Leeds Beckett University. Conference contribution. https://hdl.handle.net/10779/leedsbeckett.29128040.v1

Pascale, F and Achour, N, (2024). Envisioning the sustainable and climate resilient hospital of the future. Public Health, 237, pp. 435-442, DOI: https://doi.org/10.1016/j.puhe.2024.10.028.

Pascale, F and Jones, K, (2025). Existing hospitals' journey into a sustainable and climate-resilient future: barriers and opportunities for estates and facilities management. Facilities, *in press.*

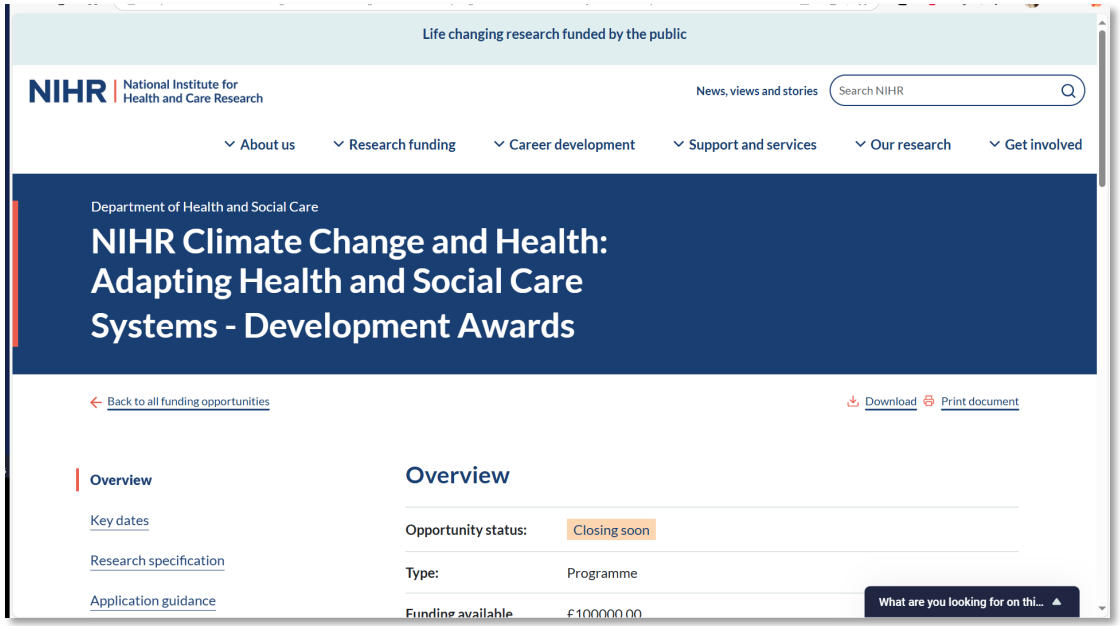
HEARTH

National Research Hub on Net Zero, Health and Extreme Heat (HEARTH)

- Funded by: UK Research and Innovation (UKRI) and National Institute for Health and Care Research (NIHR)
- Time frame: 2025-2030
- Project aim: HEARTH is one of seven new transdisciplinary research hubs exploring ways to ensure the UK's transition to net zero also protects and promotes physical and mental health.
- HEARTH | Centre for Behaviour Change - UCL – University College London

Future research projects on climate adaptation in healthcare

NIHR - Climate Change and Health: Adapting Health and Social Care Systems - Development Awards



NIHR - The impact of local climate change adaptation on health and health inequalities.

Conclusions

- There is a clear and pressing need to develop research initiatives focused on climate adaptation within the healthcare sector, highlighting the increasing urgency for support in healthcare decision-making.

- We identified completed and nearly completed research projects that aim to create:
  - Practical strategies for the adaptation of the NHS Retained Estate, ensuring resilience in the face of climate change.
  - Hands-on, universally applicable tools and resources, including streamlined procurement processes to enhance efficiency.
  - Comprehensive frameworks that equip hospitals with integrated mitigation and adaptation strategies, thereby informing effective facilities and built asset management planning.

- Additionally, we have pinpointed newly initiated research projects that will investigate how the UK's transition to net zero can safeguard and enhance both physical and mental health—particularly for vulnerable populations—and upcoming funding opportunities that will support these essential initiatives.

Thank you for your attention!

Any questions?