

# De<sup>2</sup>RHECC

Design and Delivery of Robust Hospital Environments in a Changing Climate

The 'Design and Delivery of Robust Hospital Environments in a Changing Climate' project is investigating economical and practical strategies for the adaptation of the NHS Retained Estate (which comprises c.14000 sites) to increase its resilience to climate change whilst meeting onerous carbon reduction targets. The current environmental performance of representative buildings on our partner Trusts' sites is currently being established; their performance in 2020, 2050, 2080 will be modelled. Fully-costed redesign strategies will be devised and modelled, and a 'catalogue' of viable redesign strategies delivered. Recent refurbishment projects are being rigorously interrogated to highlight opportunities for (and barriers to) change. Tools and models are being developed for Trusts to assess the effects of their decision-making and to consider the impacts of refurbishment on their campuses. The research began in October 2009 and continues until October 2012.

**Principal Investigator:** Professor Alan Short (Architecture, Cambridge)  
**Co-investigators:** Professor John Clarkson (Engineering Design Centre, Cambridge); Professor Kevin Lomas (Civil and Building Engineering, Loughborough)  
**Researchers:** Dr Claudia Eckert (Design Group, Open University); Dr Cath Noakes (Pathogen Control Research Group, Leeds)  
**Partner NHS Trusts:** Dr Labi Ariyo, Dr Alistair Fair, Dr Giri Renganathan, Dr Stamatina Rassia, Ms Pam Garthwaite, Ms Mary Lou Masko  
 Bradford Teaching Hospitals; West Hertfordshire; University Hospitals of Cambridge; University Hospitals of Leicester.



### Delphi Survey – Defining Resilience

Hospitals must be able to withstand the impacts from disruptive events in order to maintain continual service. These challenges include disruptive weather events resulting from a changing climate. Therefore, it is essential that hospitals increase their resilience to climate change. The term, 'resilience', has an established pedigree in ecological and engineering systems. The UK Government uses it with reference to emergency preparedness in response to disasters or terrorist events. Therefore, we are conducting a Delphi survey to establish a baseline definition of 'resilience' in healthcare and also develop resilience indicators.

**Modified Delphi Survey Method** – we are using a modification of the Delphi survey technique, which is an iterative process. It is a series of three or four questionnaires or 'rounds' interspersed by anonymous feedback to the participants. The process seeks to gain the most reliable consensus of opinion of a group of experts.

**Round 1** – identified issues regarding resilience and the impacts from heat waves and other disruptive weather events.

**Round 2** – determined two things:

- 1) most significant categories for resilience (categories which receive more than 70% of responses as a significant contribution towards achieving resilience or higher).
- 2) temperature ranges for ideal and critical thresholds

### Preliminary Results from Round 2

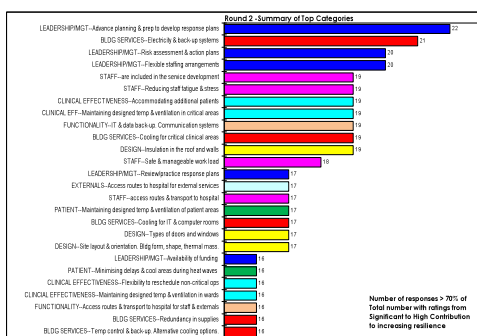
Participants were asked to rate how important it is for a hospital to be resilient for various types of disruptive events. Results are as follows:

1. Pandemic flu outbreaks or other diseases 4.7
2. Extensive utility disruptions 4.7
3. Significant staff shortages 4.6
4. Extreme weather events 4.4
5. Extensive disruptions to water/food supplies 4.3
6. Major accidents (e.g. airplane crash) 3.9
7. Severe geologic events (e.g. earthquakes) 3.6
8. Terrorist attacks or acts of war 3.5

Response to date	Round 1 25 Mar 2010	Round 2 23 Jul 2010
Total invited	125	124
Response (22%)	UK = 46 USA = 77 Other = 2	UK = 17 USA = 10 Other = 1

### Summary of Top Categories

Shown right is a summary of the top categories that were rated as providing a significant contribution to achieving resilience or higher.



### Ideal & Critical Temperature Ranges

Participants were asked to choose the maximum indoor DAYTIME temperatures for two conditions:

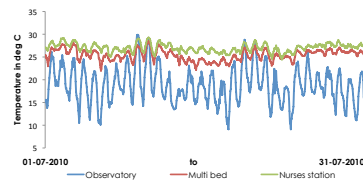
- IDEAL temps for working environment
- CRITICAL conditions during heat waves where functions become impaired and spaces become problematic.

Round 2 results are shown in this table.

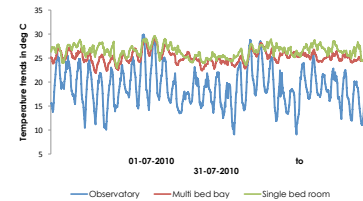
Hospital space	Ideal Temp		Critical Temp where functions become impaired	
	19°C	20°C	23°C	25°C
IT rooms & data centres				
Pharmacy & service units				
Ward				
Pharmacy				
Critical clinical areas (oper theatres, ICU, emergency)				
Physiology, ward theatre				
Public areas, corridors, lift				
Laundry, stores & storage				
Clean clinical support areas				
Labo or staff room				
Patient wards				
Clinical control				
Service lifts, corridors				
Staff areas				
Administration areas				

### Environmental monitoring, summer 2010 – selected results

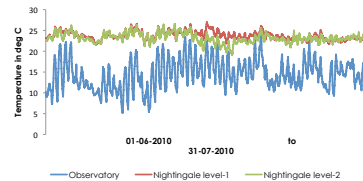
#### Hourly temperature trends – Addenbrooke's level 6



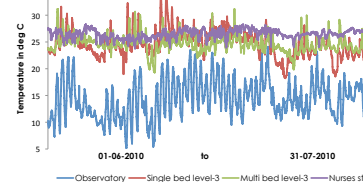
#### Hourly temperature trends - Rosie level 2



#### Hourly temperature trends – Bradford Nightingale wards



#### Hourly temperature trends – Bradford Women's/Newborn level 3



NB that observatory data may be some slight distance from the case study sites. These preliminary results reveal that the 1930s Nightingale wards at Bradford performed particularly well. The 1960s Women's/Newborn building, on the other hand, performed poorly. Current guidance suggests that wards should range between 23-25 degrees C, and that fewer than 50 hours/year should be above 28 degrees C. The team is now devising costed redesign strategies based on these results and our ongoing monitoring.

**Impacts and Stakeholder engagement:** article introducing the project in widely-read *Health Estates Journal*; project publicised on websites including *Building Better Healthcare* and *2degrees*; much interest from NHS Trusts in the work; engagement with health professionals in North America, Australasia. Second **Sounding Panel** meeting 12 October, including representatives of Departments of Health, Communities & Local Government, CABE.