Building Overheating and Health

New homes and our health, 25th Nov 2016
Good Homes Alliance 10th anniversary conference series

Dr. Angie Bone, Head of Extreme Events and Health Protection, Environmental Change Department, Centre for Radiation, Chemicals and Environmental Hazards

ExtremeEvents@phe.gov.uk
Introduction to PHE
Public Health England’s Mission

“To protect and improve the nation’s health and to address inequalities, working with national and local government, the NHS, industry, academia, the public and the voluntary and community sector.”
PHE’s role

- Preparing for, and responding to, emergencies
- Protection from infectious disease
- Protection from environmental hazards
- Protecting and improving global health
- Improving health and wellbeing and reducing inequalities
- Supporting the NHS
- Supporting and developing the public health system
Our national and local presence

- **PHE Colindale** includes infectious disease surveillance and control, reference microbiology, other specialist services such as sequencing and high containment microbiology, plus food, water and environmental services.

- **PHE Chilton** includes the Centre for Radiation, Chemical and Environmental Hazards (CRCE).

- **PHE Porton** includes departments for rare and imported pathogens, research, PHE Culture Collections and emergency response, plus food, water and environmental services.
Extreme events and Health Protection

‘Any extreme weather event or other natural hazard with the potential to cause adverse impact on human health’

1. Cold Weather
2. Heatwave
3. Floods

Drought
Wildfires
Landslides
Windstorms

Earthquakes
Tsunamis
Volcanic ash
Space weather
Heat health impacts
Summer 2003

70,000 deaths in Europe
15,000 deaths in France

Particularly significant in Paris:

- temperature extremes: high minimum temperature
- poor meteorological forecast
- institutional failures: hospital and care home staff on holiday
- surveillance: small number of deaths reported
- no experience/knowledge: no public health measures
- “We didn’t know anything..” French Minister of Health
• Elderly, esp >75 years old, those living on their own/socially isolated, or individuals in care homes

• Infants

• Individuals with chronic and severe illness: including heart conditions, diabetes, respiratory or renal insufficiency, Parkinson’s disease or severe mental illness.

• Those on medication that can affect renal function, the body’s ability to sweat, thermoregulation (e.g. psychiatric medications) or electrolyte balance (diuretics)

• Individuals unable to adapt their behaviour to keep cool such as having Alzheimer’s, a disability, being bed bound, drug and alcohol dependencies.
Threshold for increase in deaths

Cumulative exposure–response association between temperature and mortality for London

From: Gasparini et al., 2015
Threshold for harm to health

Estimated heat thresholds for each region, plotted against mean summer temperatures

From: B G Armstrong et al. (2011)
Health system impact

Heatwave sparks rise in accidents and A&E visits, say medics

PHE Syndromic Surveillance Summary

Diagnostic indicators at a glance:

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Current trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myocardial Ischaemia</td>
<td>decreasing</td>
</tr>
<tr>
<td>Meningitis</td>
<td>no trend</td>
</tr>
<tr>
<td>Heat/sunstroke</td>
<td>no trend</td>
</tr>
</tbody>
</table>

Emergency admissions (1994-2000)

- No impact on total admissions
- BUT renal/respiratory (<5 yrs) and respiratory (75+ yrs)
- Most deaths occur in community but hospitals part of a system

(Johnson and Bickler 2007), (Kovats, Hajat et al. 2004)
Heatwave Plan
Heatwave Alert Levels

Figure 2.1: Heatwave Alert levels

<table>
<thead>
<tr>
<th>Level 0</th>
<th>Long-term planning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All year</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Heatwave and Summer preparedness programme</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1 June – 15 September</td>
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</table>

<table>
<thead>
<tr>
<th>Level 2</th>
<th>Heatwave is forecast – Alert and readiness</th>
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<tr>
<td></td>
<td>60% risk of heatwave in the next 2–3 days</td>
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<thead>
<tr>
<th>Level 3</th>
<th>Heatwave Action</th>
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<tbody>
<tr>
<td></td>
<td>Temperature reached in one or more Met Office National Severe Weather Warning Service regions</td>
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<thead>
<tr>
<th>Level 4</th>
<th>Major incident – Emergency response</th>
</tr>
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<tr>
<td></td>
<td>Central Government will declare a Level 4 alert in the event of severe or prolonged heatwave affecting sectors other than health</td>
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</table>

<table>
<thead>
<tr>
<th>NSWWS Region</th>
<th>Day</th>
<th>Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>London</td>
<td>32</td>
<td>18</td>
</tr>
<tr>
<td>South East</td>
<td>31</td>
<td>16</td>
</tr>
<tr>
<td>South West</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Eastern</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>West Midlands</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>East Midlands</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>North West</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Yorkshire and Humber</td>
<td>29</td>
<td>15</td>
</tr>
<tr>
<td>North East</td>
<td>28</td>
<td>15</td>
</tr>
</tbody>
</table>
UK adaptation policy cycle

Source: Committee on Climate Change (2015b)
UK health-related climate priorities

<table>
<thead>
<tr>
<th>Adaptation priorities</th>
<th>Is there a plan?</th>
<th>Are actions taking place?</th>
<th>Is progress being made in managing vulnerability?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Public understanding of climate change risks</td>
<td>Red</td>
<td>Green</td>
<td>Amber</td>
</tr>
<tr>
<td>2. Heat-related health impacts</td>
<td>Amber</td>
<td>Green</td>
<td>Red</td>
</tr>
<tr>
<td>3. Cold-related health impacts</td>
<td>Green</td>
<td>Green</td>
<td>Amber</td>
</tr>
<tr>
<td>4. Pathogens, air pollution and UV radiation</td>
<td>Amber</td>
<td>Green</td>
<td>Grey</td>
</tr>
<tr>
<td>5. Capability of the health and social care system</td>
<td>Amber</td>
<td>Green</td>
<td>Grey</td>
</tr>
<tr>
<td>6. Capability of the emergency planning system</td>
<td>Green</td>
<td>Green</td>
<td>Grey</td>
</tr>
<tr>
<td>7. Capacity of people and communities to recover from flooding</td>
<td>Amber</td>
<td>Green</td>
<td>Grey</td>
</tr>
</tbody>
</table>

Main issues

- Heat
  - Indoor overheating
  - Urban greenspace
- Cold
- Flooding
- Air quality
- Health and social care assets (& staff)
- Capability to respond to emergencies
- Public understanding of CC risk

Source: Committee on Climate Change (2015b)
Overheating in buildings
'At present, there are no comprehensive policies in place to adapt existing homes and other buildings to high temperatures, manage urban heat islands, nor safeguard new homes. The level of risk from overheating across the UK is unknown for hospitals, care homes, schools, prisons, and places of work.'

'There is evidence that people lack a basic understanding of the risks to health from indoor high temperatures, and are therefore less likely to take measures to safeguard their and their dependents’ wellbeing. Insulating homes to improve thermal efficiency needs to be undertaken carefully to avoid increasing the risk of overheating.'
Build environment responses to climate change

Heat deaths

Source: Zero Carbon Hub (n.d.)

Source: ARUP (2014b)

Source: Hajat et al. (2014)
Limited evidence:

• 50% of French deaths in homes during 2003 heatwave
• 80% of heat strokes in New York City due to exposure at home
• Indoor health thresholds challenging to establish!
• Impact of interventions on health, productivity, inequalities…?

Subject of ongoing research eg:

• NERC AWESOME project
• NIHR Health Protection Research Unit in Environmental Change
Project 1 – Modelling overheating in dwellings.

A simulation model is being developed, based on a validated building physics models (e.g. Energy Plus) and applied to housing survey and building stock and occupancy data for England. Data gathered from an indoor temperature measurement campaign for over 800 dwellings representative of the English stock will enable detailed analysis of overheating risk factors along with the further development of the modelling tools.

Researchers

Prof Michael Davies, Mr Ian Hamilton, Dr Anna Mavrogianni, Mr Clive Shrubsole, Dr Jonathon Taylor, Dr Sotiris Vardoulakis

Project 2 – Evaluating housing interventions to reduce the impact of heatwaves

Overheating in houses is a significant problem in England and likely to increase with climate change. This research will use epidemiological methods to examine modification of the temperature-related risks (heat and cold) by housing type. The results will then be used to develop models for quantification of current and future heat-related burdens under alternative strategies of adaptation in the housing sector and the built environment.

Researchers

Prof Paul Wilkinson, Mr Clive Shrubsole, Dr Anna Mavrogianni, Dr Jonathon Taylor, Dr Roberto Picetti
Risk profiles: flats

**Tenancy:** elderly, impaired mobility, respiratory condition, mostly home  
**Building:** south facing, poorly insulated, no shading, UHI, main road

**Tenancy:** Young family, child with asthma, home during the day  
**Building:** top floor conversion, west facing, dual aspect, poorly insulated walls/roof, UHI

**Tenancy:** Young couple, no children, work away from home  
**Building:** mid level, well insulated outside UHI, west facing window with shading and balcony
This slide pack is part of a series. All are available for download at www.zerocarbonhub.org.
Assessment Protocol

Overheating in dwellings

Andy Dengel (BRE), Mich Swainson (BRE),
David Ormandy (Warwick Medical School, University of Warwick – BRE Trust Research Fellow),
Véronique Ezratty (Service des Études Médicales, EDF; Levallois-Perret, France)

Guidance Document

Overheating in dwellings

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**Risk factors**

- Building type. 90% of existing wards prone to O/H.
- Concentration of vulnerable groups highest in hospitals and care homes

**Drivers**

- Energy efficiency (NHS: 30% public sector; 3% of total UK emissions)
- Health and safety: limited opening of windows.
- Climate change, ageing, urbanisation.
- Heat drives hospital admissions and vulnerability profile changing

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*Table I*

<table>
<thead>
<tr>
<th></th>
<th>Age under 75 years</th>
<th>Age 75 years and over</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage increase</td>
<td>Estimated number of excess deaths</td>
</tr>
<tr>
<td></td>
<td>(95 per cent confidence interval)</td>
<td></td>
</tr>
<tr>
<td>Own home</td>
<td>13.2 (4.3, 22.0)</td>
<td>73</td>
</tr>
<tr>
<td>General Hospital</td>
<td>11.3 (5.3, 17.4)</td>
<td>134</td>
</tr>
<tr>
<td>Hospice</td>
<td>8.6 (-6.4, 24.1)</td>
<td>16</td>
</tr>
<tr>
<td>Nursing Home</td>
<td>49.6 (15.5, 82.5)</td>
<td>25</td>
</tr>
<tr>
<td>Residential Home</td>
<td>71.6 (17.0, 133.0)</td>
<td>15</td>
</tr>
<tr>
<td>Other places</td>
<td>19.6 (-0.5, 40.2)</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>13.5 (9.0, 18.2)</td>
<td>284</td>
</tr>
</tbody>
</table>

*Deaths to residents of Government Office Regions for the South East, South West, East of England and London.*

Health Statistics Quarterly 29 Spring 2006, Kovats
DeDeRHECC and two subsequent studies

- 5-6 basic types of hospital ward
- Risk of overheating and use of energy varies according to type, but also location and orientation
- Solar gain is a key driver
- Poor maintenance and uncontrolled internal gains exacerbate the problem.
- Mechanical ventilation without heat recovery is very energy intensive.
- Ceiling fans are safe and can improve comfort in warm weather.

Source, DeDe RHECC, Prof Alan Short (Cambridge University) and Prof Kevin Lomas (Loughborough University)
Public Health England

Health & Social care estates

Health Technical Memorandum 07-02: EnCO_{2}de 2015 – making energy work in healthcare

Environment and sustainability
Part A: Policy and management
1.4 Patients’ and staff wellbeing: thermal comfort and health

- environmental factors affect staff satisfaction and patient health
- all influenced by attempts to improve energy efficiency in hospitals
- natural tendency to adapt to changing environmental conditions
- building designers can estimate internal temperatures at which occupants are likely to feel comfortable in free-running buildings
- but patients in hospital may be more vulnerable and less able to adapt:
  - Older age groups, unwell
  - Disordered thermoperception
  - Immobile, difficulty adjusting bedding, windows, accessing fluids
Recommendation

1.4.15 Adaptive thermal comfort guidance is recommended for non-clinical areas.

1.4.16 For each clinical area, decisions about setting environmental conditions should only be made after careful judgements as to the vulnerability and duration of stay of the intended patients.

In all clinical areas, year round internal temperature monitoring is recommended.

At any time of the year where temperatures are found to exceed 26°C, a risk assessment should be carried out and appropriate action taken to ensure the safety of vulnerable patients.
Overheating is current risk; but little awareness

Perceptions that ‘old means cold’

Overheating and climate change rarely considered in design or briefs

Mismatch between modelled and monitored temperatures

Lack of effective heat management

Collaboration need to standardise overheating thresholds,
In summary

• Heat has significant health impacts; some population groups are more susceptible than others

• Exposure to indoor heat is thought to be an important mediator, but there are research and policy/practice gaps that need to be filled

• The Heatwave Plan for England offers a framework to reduce risks to health, encompassing year-round, upstream interventions as well as emergency responses
Acknowledgements

Virginia Murray
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Thomas Waite

Get in touch! ExtremeEvents@phe.gov.uk