Public Health England

NHS England

Heatwave Plan for England 2013

Making the Case:
the impact of heat on health –
now and in the future



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Local Government Association

Met Office

Contents

CHAPTER 1

Health Issues related to heatwaves

There is a large and strong evidence base about the risks to health from excess heat.

Many of the deaths due to excessive heat exposure are preventable if a few very simple precautions are taken.

The purpose of the Heatwave Plan is to avoid the adverse health effects of excessive heat by raising public awareness and triggering actions by those in contact with people who are most at risk. This, in turn, could help to reduce pressures throughout the health and social care system.

1.1 The effects of heat on health

The body normally cools itself using four mechanisms:

- radiation in the form of infrared rays;
- convection via water or air crossing the skin;
- conduction by a cooler object being in contact with the skin; and
- evaporation of sweat.

Increasing temperatures in excess of approximately 25ºC are associated with excess summer deaths, with higher temperatures being associated with greater numbers of excess deaths; at 27ºC or over, those with impaired sweating mechanisms find it especially difficult to keep their bodies cool.

When the ambient temperature is higher than skin temperature, the only effective heat-loss mechanism is sweating. Therefore, any factor that reduces the effectiveness of sweating such as dehydration, lack of breeze, tight-fitting clothes or certain medications can cause the body to overheat.

Thermoregulation, which is controlled by the hypothalamus, can be impaired in the elderly and the chronically ill, and potentially in those taking certain medications, rendering the body more vulnerable to overheating. Young children produce more metabolic heat, have a decreased ability to sweat and have core temperatures that rise faster during dehydration.

Box 1 describes the effects of overheating on the body, which in the form of heatstroke can be fatal.

However, the main causes of illness and death during a heatwave are respiratory and cardiovascular diseases.

A linear relationship between temperature and weekly mortality was observed in England in summer 2006, with an estimated 75 extra deaths per week for each degree of increase in temperature. Part of this rise in mortality may be attributable to air pollution, which makes respiratory symptoms worse. The other main contributor is the effect of heat on the cardiovascular system.

In order to keep cool, large quantities of extra blood are circulated to the skin. This causes strain on the heart, which for elderly people and those with chronic health problems can be enough to precipitate a cardiac event, for example heart failure. Additionally, death rates increase in particular for those with renal disease. An increase in suicide rates during previous heatwaves in the UK has also been observed.

Sweating and dehydration affect electrolyte balance. For people on medications that control electrolyte balance or cardiac function, this can also be a risk. Medicines that affect thermoregulation, the ability to sweat, or electrolyte imbalance can make a person more vulnerable to the effects of heat. Such medicines include anticholinergics, vasoconstrictors, antihistamines, drugs that reduce renal function, diuretics, psychoactive drugs and antihypertensives.

Evidence also exists that links increased ambient temperatures and associated dehydration with an increase in bloodstream infections caused by Gram-negative bacteria, particularly *Escherichia coli.*[1] The risk is greatest in individuals aged over 65, emphasising the importance of ensuring adequate fluid intake in older people during periods of raised temperatures to reduce the risk of infection.

Air pollution such as ozone and particulate matter (eg PM10, PM2.5) also increases the level of cardiovascular-related deaths, as fine

Box 1: Heat-related illnesses

The *main causes of illness and death* during a heatwave are ***Respiratory and Cardiovascular diseases***. Additionally, there are specific heat-related illnesses including:

- **heat cramps** – caused by dehydration and loss of electrolytes, often following exercise;
- **heat rash** – small, red, itchy papules;
- **heat oedema** – mainly in the ankles, due to vasodilation and retention of fluid;
- **heat syncope** – dizziness and fainting, due to dehydration, vasodilation, cardiovascular disease and certain medications;
- **heat exhaustion (**more common) - occurs as a result of water or sodium depletion, with non-specific features of malaise, vomiting and circulatory collapse, and is present when the core temperature is between 37ºC and 40ºC. Left untreated, heat exhaustion may evolve into heatstroke; and
- **heatstroke** – can become a point of no return whereby the body's thermoregulation mechanism fails. This leads to a medical emergency, with symptoms of confusion; disorientation; convulsions; unconsciousness; hot dry skin; and core body temperature exceeding 40ºC for between 45 minutes and eight hours. It can result in cell death, organ failure, brain damage or death. Heatstroke can be either classical or exertional (e.g. in athletes).

1 Al-Hasan MN, Lahr BD, Eckel-Passow JE, Baddour LM. Seasonal variation in *Escherichia coli* bloodstream infection: A population-based study. *Clin Microbiol Infect* 2009; **15**(10): 947-50.

particles have been shown to enter the blood stream via the lungs and affect the heart.[2]

Whatever the underlying cause of heat-related symptoms, the treatment is always the same – move the person to somewhere cooler and cool them down.

1.2 High-risk factors and vulnerable groups of people

There are certain factors that increase an individual's risk during a heatwave. These include:

- **older age**: especially over 75 years old, or those living on their own who are socially isolated, or in a care home;
- **chronic and severe illness**: including heart conditions, diabetes, respiratory or renal insufficiency, Parkinson's disease or severe mental illness. Medications that potentially affect renal function, the body's ability to sweat, thermoregulation (e.g. psychiatric medications) or electrolyte balance (diuretics) can make this group more vulnerable to the effects of heat;
- **infants** are vulnerable to heat due to immature thermoregulation, smaller body mass and blood volume, high dependency level, dehydration risk in case of diarrhoea;
- **homeless people** (those who sleep in shelters as well as outdoors) may be at increased risk from heatwaves. Higher rates of chronic disease (often poorly controlled), smoking, respiratory conditions, substance dependencies and mental illness are more frequent homeless populations than in the general population. These risk factors increase the risks of heat related morbidity and mortality, on top of social isolation, lack of air conditioning, cognitive impairment, living alone and being exposed to urban heat islands;
- **people with alcohol dependence and drug dependence** often have poorer overall health and increased social isolation which can increase their risk of heat stress;
- **inability to adapt behaviour** to keep cool such as having Alzheimer's, a disability, being bed bound, drug and alcohol dependencies, babies and the very young; and
- **environmental factors and overexposure:** living in urban areas and south-facing top-floor flats, being homeless, activities or jobs that are in hot places or outdoors and include high levels of physical exertion, children and adults taking part in organised sports (particularly children and adolescents).

In a moderate heatwave, it is mainly the high-risk groups mentioned above who are affected. However, during an extreme heatwave such as the one affecting France in 2003, fit and healthy people can also be affected.

A recent review of the evidence as it affects vulnerable groups of people is being published as part of the Equality Impact Analysis at the same time as this plan. Other groups of people who might be at heightened risk to those noted above might be older carers; and tourists and people attending large scale public events.

People from minority ethnic groups do not seem to have a higher risk of suffering

2 See: Committee on the Medical Effects of Air Pollution (COMEAP). http://comeap.org.uk/

adversely from heatwaves per se. However there is evidence to show that when there is a heatwave the urban 'heat island' effect increases mortality rates. As significant proportions of minority ethnic groups live in urban environments, they may be at increased risk from heatwave with others living in towns and cities. Those people from the Muslim community fasting over Ramadan might also be at heightened risk as this year Ramadan takes place between 9th July to 7th August 2013. (See Box 2 in the main Heatwave Plan).

The general guidance contained in the Heatwave Plan is applicable to these groups. Authorities with large numbers of tourists for example should be aware of potential risks and take appropriate preventive actions.

1.3 High Temperatures, Air Quality and Health

High temperatures are also linked to poor air quality with high levels of ozone which are formed more rapidly in strong sunlight; fine particles (PM10, PM2.5) also increase in concentration during hot, still air conditions. Both are associated with respiratory and cardiovascular mortality.

Given the recent predictions of the impact of climate change in the UK (UKCP09), recommendations made in the Heatwave Plan aim to be energy neutral, except in very high-risk situations where lives may be saved.

Thunderstorm asthma is a term used to describe any observed increase in acute bronchospasm cases following the occurrence of thunderstorms in the local vicinity, placing increased pressures on health services. Although thunderstorm asthma doesn't occur after every thunderstorm, it is important that professionals and the general public are aware of the potential risks over the summer period.

Aeroallergens (pollen), hay fever and related respiratory diseases Aeroallergens are not just a heatwave issue but their presence during a heatwave may exacerbate respiratory symptoms. Variations in the potency of allergen carriers (e.g. the amount of allergen per pollen grain) might make it difficult to correlate symptoms and effectiveness of treatment with pollen or fungal spore counts. The problem of variations in potency might be overcome by monitoring atmospheric concentrations of allergens instead of pollen grains or fungal spore counts. Climate change may result in earlier seasonal appearance of respiratory symptoms and longer duration of exposure to aeroallergens. The effects of climate change on plant distribution through range shifts and invasions can expose the population to pollen from more plants with different flowering seasons. Although aeroallergens can be present during heatwaves, it is important that professionals and the general public are aware of the potential risks over the summer period.

For more information please see the Health Protection Agency website on aeroallergens, pending migration to the new Public Health England site.

1.4 Heatwaves and Geography

People gradually adapt to changing temperature patterns, and therefore heatwaves are a relative experience. We adapt to temperature during each summer and gradually over long periods of time; however, there is always a level to which we become accustomed. Therefore, thresholds vary for each region and risks to health

Box 2 Information on air quality

Regular updates on levels of particulate matter (PM10 and PM2.5), sulphur dioxide, nitrogen dioxide and ozone are available on http://uk-air.defra.gov.uk/ which offers health advice to those who may be particularly sensitive to air pollution.

Alert systems are available to remind those at risk to take their medication (inhalers etc), otherwise advice to those with respiratory problems is consistent with the advice to all

others during a heatwave – to keep windows shaded and closed when outside temperatures are hotter during the daytime to reduce heat (and ozone) entering the home; and opening windows at night or when it is cooler outside, to aid cooling of their home.

Ozone is the main air pollutant that affects respiratory symptoms during heatwaves and has a diurnal variation, peaking during the hottest period of the day and dropping to very low levels at night. Other air pollutants tend to be at lower levels indoors, and therefore the other main advice to those with respiratory problems is to reduce activity, particularly outdoors, and especially during the hottest period of the day. If you would like more information about air pollution in the UK or health advice to those who may be particularly sensitive to air pollution:

- automated freephone recorded information service run by Defra on **0800 55 66 77**
- Defra website (http://uk-air.defra.gov.uk/) or
- follow UK-AIR on Twitter: @DefraUKAIR.

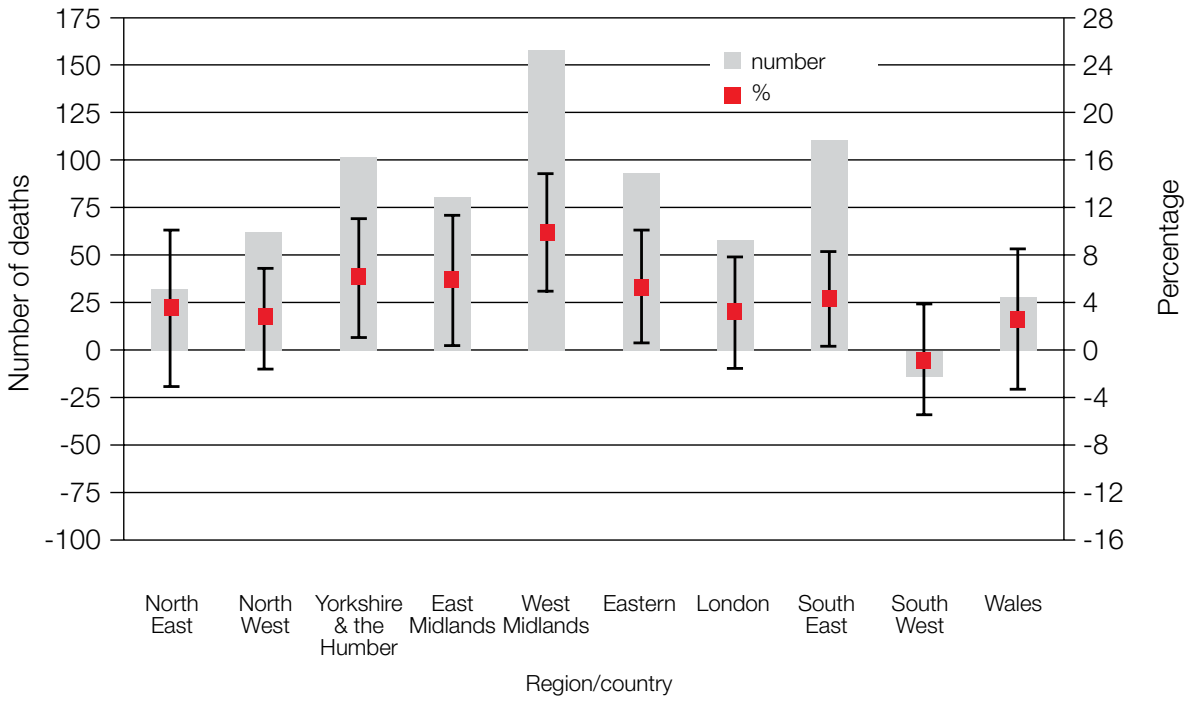
These provide regular updates on levels of particulate matter (PM10 and PM2.5), sulphur dioxide, nitrogen dioxide and ozone across the UK.

appear to be greater earlier in the summer. In northern parts of England the temperature threshold is lower than for London and the South East. This explains the variation in the Met Office National Severe Weather Warning Service regional heatwave temperature thresholds listed in Annex 1 of the Heatwave Plan.

Excess summer deaths show regional variations, which relate largely to differences in temperature levels across the country (see Figure 1). The excess deaths and illness related to heatwaves occur in part due to our inability to adapt and cool ourselves sufficiently. Therefore, relatively more deaths occur in the first days of a heatwave, as happened in 2006 during the first hot period in June (which did not officially reach heatwave status). This emphasises the importance of being well prepared for the first hot period of the season and at the very beginning of a heatwave, as well as for prolonged and sustained periods of unusually hot weather.

Figure 1: Regional variations in excess mortality.

Number and percent of excess deaths between 16 and 28 July 2006 by Government Office Region of England, and Wales, (Health Statistics Quarterly, 32)



1.5 Drought

A drought is a period of water shortage for people, the environment, agriculture or industry and a hot, dry summer can cause a short, intense drought. There are several health impacts associated with drought. However, in developed countries like England, with robust health and sanitation systems, the potential for drought-related health effects is low.

Health impacts that may be relevant include:

- **Injury** – Drought conditions increase the risk of shallow water in rivers, reservoirs and other natural bodies of water. Diving into shallow water can cause injury, including serious spinal injury leading to lifelong paralysis. Co-incident high temperatures may tempt people to swim in unknown waters, of unknown depth, with unknown hazards hidden just beneath the surface.
- **Public water supplies** – In the UK, public drinking water supplies are tightly regulated to ensure they are safe. The Drinking Water Inspectorate (DWI) provides an independent reassurance that public water supplies in England and Wales are safe and drinking water quality is acceptable to consumers. Warnings are issued in case of any problems. For more information please see: Drinking Water Safety: Guidance to health and water professionals
- **Private water supplies**- Private water supplies serve one percent of the population in England and Wales. During a drought, continued vigilance is needed to ensure water remains of adequate quality and quantity. For more information on private water supplies please see the publications from the Drinking Water Inspectorate: Keeping your private water

supply safe or Legislation of private water supplies and drought

- **Hand washing** – Whilst it is important to minimise water wastage during a drought, hand washing should still continue as normal as this is one of the most effective ways to prevent transmission of infectious diseases.
- **Algal blooms** – Some algal blooms and their surface scums, which grow on open waters and are often blown onto shorelines, can release toxins which adversely affect human and animal health. Symptoms following ingestion of contaminated water during recreational activities include gastro intestinal effects (e.g. abdominal pain, nausea, vomiting and diarrhoea) and respiratory features (e.g. sore throat and cough). Symptoms following recreational exposure include skin and eye irritation, respiratory features, and hay fever/asthma-like symptoms. Water treatment removes algal bloom contamination from drinking water.
- **Dust-related problems** – Parched soils can increase the amount of dust in the environment as can dust from wildfires/ fires which commonly occur during drought. This may have consequences for those with pre-existing respiratory or cardiovascular disease.
- **Mental health and wellbeing** – Drought can be difficult for those whose livelihood or lifestyle depends on water. If drought conditions continue and worsen then, for example, farmers and rural populations may experience stress related to financial worries and employment uncertainty.

For more information please see the Health Protection Agency website on drought, pending migration to the new Public Health England site.

1.6 Ultraviolet (UV) radiation

Ultraviolet (UV) radiation may cause harm during heatwaves but also at other times when people expose themselves to the sun. While small doses of UV from the sun help the body produce vitamin D, excessive exposure is damaging to human health. Excessive exposure may have consequences ranging from premature ageing of the skin to skin cancer. WHO state that the number of cases of malignant melanoma has doubled every 7 to 8 years over the last 40 years – mostly due to a marked increase in the incidence of skin cancers in fair-skinned populations since the early 1970s. This is strongly associated with personal habits: the societal view is that a tan is desirable and healthy. Children are most at risk, as exposure to the sun during childhood appears to set the stage for the development of skin cancer later in life. UV radiation can also severely damage the cornea and lens of the human eye – long exposures may result in photo keratitis and a lifetime of cumulative exposure contributes to the risk of cataracts and other forms of ocular damage.

For more information please see the Health Protection Agency website on UV, pending migration to the new Public Health England site.

Box 3 Ten ways to minimise UVR-induced skin and eye damage: the PHE sunsense guide

- Take sensible precautions to avoid sunburn, particularly in children.
- Remember that a suntan offers only modest protection against further exposure. It is not an indication of good health.
- Limit unprotected personal exposure to solar radiation, particularly during the four hours around midday, even in the UK.
- Seek shade, but remember sunburn can occur even when in partial shade or when cloudy.
- Remember that overexposure of skin and eyes can occur while swimming and is more likely when there is a high level of reflected UVR, such as from snow and sand.
- Wear suitable head wear, such as a wide-brimmed hat, to reduce exposure to the face, eyes, head and neck.
- Cover skin with clothing giving good protection – examples are long-sleeved shirts and loose clothing with a close weave.
- Sunglasses should exclude both direct and peripheral exposure of the eye to UVR, i.e. be of a wraparound design.
- Apply sunblocks, or broad-band sunscreens with high sun protection factors (at least SPF 15) to exposed skin. Apply generously and reapply frequently, especially after activities that remove them, such as swimming or towelling.

Remember that certain individuals have abnormal skin responses to UVR and may need medical help. Certain prescribed drugs, medicines, foods, cosmetics and plant materials can also make people more sensitive to sunlight.

PHE Sunsense guidance (last reviewed in October 2009).

CHAPTER 2

The Future – why long-term planning is essential

The climate is changing and current analysis in the UK Climate Change Risk Assessment 2012 suggests that summers are going to get hotter in the future:
"despite the uncertainties related to future climate change and its impacts, the evidence is now sufficient to identify a range of possible outcomes that can inform adaptation policies and planning…"
For example, there is high confidence that heat-related deaths will increase to between 130-1700/ year by the 2020s.

The Intergovernmental Panel on Climate Change (IPCC) also predicts that as a result of climate change, it is *very likely* that heatwaves will increase in frequency, duration and intensity (Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX), IPCC 2012).

The UK CCRA 2012 considers that *"rising temperatures, mainly during the summer, may result in an increase in deaths and hospital admissions due to cardio-vascular and respiratory illnesses. This may particularly affect vulnerable groups such as the elderly. South-east England may be the region most affected"*.

The Assessment goes on to note: "Healthcare provision may also be affected by heatwaves if temperatures in hospital wards, care homes and medicine stores are not effectively controlled, affecting both patient recovery and the performance of staff. In addition, warmer temperatures may contribute to some increased risk from water-borne and food-borne diseases as well as diseases carried by insects and parasites."

Climate change will result in "changes in temperature, rainfall patterns and sea levels and will have a range of impacts on human health in the UK, mainly due to higher average temperatures and an increase in the frequency and severity of extreme weather events (e.g. floods and heatwaves). In some cases, the effects of climate change may exacerbate, or be exacerbated by, other pressures on the sector" (UK CCRA 2012 – Health Sector Report).

As a result we might also expect increased risks associated with summer and heatwaves of increased exposure to sunlight; ozone; and flooding.

Although, climate change awareness is gradually increasing within the health sector, the Assessment notes that "sectors such as the built environment, agriculture and floods and coastal erosion have a direct bearing on people's health, so their adaptation to climate change will have a significant influence on health and wellbeing across the UK".

In other words, unless we take steps now to plan for the longer term changes we will not be prepared. Moreover, these need to be taken on a multi-agency basis in conjunction with partners to meet the expected challenges posed by climate change in the medium and longer term.

CHAPTER 3

Preparing to meet the Challenge

England however is in a good position to meet these challenges. Indeed, the Heatwave Plan draws on experience since 2004 in preparing the general public; the NHS and partners in social care, local authorities and in the community and voluntary sector to recognise; prepare for; and deal with the health impacts of heatwaves.

As with most factors affecting health, to address the multi-factorial nature of the root causes requires concerted and coordinated efforts across agencies. The development of **Local Health Resilience Partnerships** and **Local Health and Wellbeing Boards**, as well as the existing **Local Resilience Forums**, could support and facilitate such co-ordinated long-term planning between agencies to protect people and infrastructure from the effects of severe hot weather and thus reduce excess summer illness and death.

The following section gives some examples of medium term and longer term actions which can be taken to mitigate or ameliorate some of the effects of future heatwaves and hot weather.

Given the recent predictions of the impact of climate change, recommendations made in the Heatwave Plan aim to be energy neutral, except in very high-risk situations where lives may be saved.

3.1 Actions which can be taken now to prepare for the future:

3.1.1 Example 1: Urban Heat Islands

Cities and urban areas tend to be hotter than rural areas, creating urban heat island effects (see Box 4). This is due to several factors, including: increased absorption and reflection of the sun on hard surfaces compared with green or brown spaces; reduced airflow and cooling from breezes in built-up areas due to buildings; and increased heat production from energy use in houses, industry, businesses and vehicles. These factors have important implications for long-term planning in order to reduce the impact of heatwaves by targeting high-risk geographical and urban areas.

There are a number of actions which can be taken locally to help mitigate the effects of hotter weather. For example, in relation to ‘urban heat islands’ at a local scale, actions which can be taken include the modification of surface properties and integration of green infrastructure, for example ‘cool roofs’, ‘green roofs’ and ‘cool pavements’.

3.1.2 Example 2: Creating cool environments with green spaces

Trees change summer urban micro-climates for the better by creating shade and allowing cooler air to accumulate and circulate at ground level. Planting trees and vegetation and the creation of green spaces to enhance

Box 4: Urban Heat Islands

During a heatwave it is likely to be hotter in cities than in surrounding rural areas, especially at night. Temperatures typically rise from the outer edges of the city and peak in the centre. This phenomenon is referred to as the 'Urban Heat Island' (UHI) effect and its impact can be significant. In London during the August 2003 heatwave, the maximum temperature difference between urban and rural locations reached 9ºC on occasions. A range of factors vary between rural and urban areas and contribute to the UHI – for example:

- **thermal properties** of building and road materials, the height and spacing of buildings and air pollution levels. These factors result in more of the sun's energy being captured, absorbed and stored in urban surfaces compared to rural surfaces during the day and a slower loss of this energy at night, thus resulting in comparatively higher air temperatures;
- **less evaporation and shading**, with the consequent reduction in associated cooling, taking place in the typically drier urban areas as there is less vegetation; and
- **greater inputs of heat** as a result of the high density of energy use in cities. All this energy, for example from buildings and transport, ultimately ends up as heat.

Strategic planning is therefore required which takes account of the above factors, particularly in the context of climate change.

evaporation and shading are other options, as temperatures in and around green spaces can be several degrees lower than their surroundings.

Trees also help to reduce the air temperature by the cooling effect of evaporation. Trees 'transpire' water, releasing large amounts of moisture into the air. One large tree can release 200 to 300 gallons of water on a summer day. Studies suggest that air-conditioning demand can be reduced by up to 30 per cent through the effects of well-placed trees. Water features such as lakes, ponds and fountains also help to cool the environment by the cooling effect of evaporation.

By extracting CO_2 from the air, trees also help to reduce the impact of climate change – over one year a mature tree will remove about 22kg of carbon dioxide from the air. Trees with white or paler leaves can potentially help to reflect heat upwards increasing their cooling effect. Additionally, creating more green spaces and planting trees speeds up drainage and reduces the risk of flooding.

Best practice and local action is promoted within the Green Infrastructure Partnership, supported by Defra, DH and DCLG, informing local practitioners on the benefits of green infrastructure including opportunities for reduced heat retention as one of the many benefits. There is considerable evidence to support the case for well-designed green infrastructure: trees, parks, green roofs, and ponds/lakes can all help to reduce heat retention.

In summary, urban green space and trees can have the following beneficial effects:

- ***reduces urban heat islands*** – predictions for urban temperatures over the next 70 years show that if there is less than 10 per cent urban green cover, urban temperatures will increase by about 8.2°C, whilst if green cover exceeds 10 per cent it will keep temperatures to only 1°C above current temperatures;
- ***reduces pollution*** – each year 1.3 million trees would remove 2,535 tonnes of pollutants from the air;
- ***reduces flooding*** – each year 1.3 million trees would catch 7 billion tonnes of rainwater, thereby reducing the impact of flooding;
- ***reduces noise*** – a belt of trees can reduce noise levels by as much as 6–8 decibels for every 30 metres width of woodland.

The development of 'green spaces' can not only help to alleviate the impact urban heat islands but have been shown to have other health impacts.

3.1.3 Example 3: How insulating homes can protect against heat

Insulating homes has multiple health benefits, improving physical and mental health. In most cases, insulating homes protects against hot weather as well as reducing heating needs in the winter. It has wider climate change benefits:

- **mitigation** – installing insulation will improve the energy efficiency of the home and will reduce CO_2 emissions by an estimated average of 1.2 tonnes/year.
- **adaptation** – helping future-proof existing homes to reduce the health impact of excessive thermal gain in the warmer summers ahead.

The way insulation is installed, as well as the way occupants use heavily insulated homes, can help protect against overheating. For instance, external wall insulation can be better than internal wall insulation in preventing overheating – as it prevents heat getting in rather than trapping it inside. This may be particularly important for instance with elderly occupants at home during the day. A small number of types of

Box 5 Wider health benefits of green space

- Living in closer proximity to green spaces is associated with improved wellbeing, reduced mental health problems, and reduced health inequalities.
- Children with attention deficit hyperactivity disorder (ADHD) have reported significant improvements in symptoms when in contact with natural environments and green spaces.
- The presence of green spaces in otherwise identical urban areas is associated with reduced indicators of stress and family aggression.
- Exposure to natural environments or scenes of nature have shown reduction in physiological stress indicators such as reduced blood pressure and muscle tension and changes to EEG alpha wave activity.
- Access to green spaces and natural environments can increase the likelihood of physical activity and active travel in adults and children.

properties – for instance light-weight top floor flats – may be vulnerable to overheating even if insulation is external.

Insulation is particularly effective in preventing overheating when it is combined with measures to keep out heat – for instance shading, awnings and shutters, or reflective external wall surfaces. Some of these measures are low cost – for instance curtains with white reflective linings kept closed during the day will help prevent heat gain through windows.

Ventilation is also important – for instance opening windows when the air outside is cooler at night time or in the early morning. Concerns about security may mean that people are reluctant to keep windows open – windows that can be locked open securely may make it easier to keep homes cool. The way buildings are designed, refurbished and maintained can help make it easier for people to do the right thing to prevent overheating.

Some homes are more vulnerable than others to overheating. Recent research suggests that:

- Top floor 1960s flats can experience over six times the overheating of ground floor flats, depending on orientation, and almost nine times that of Victorian terraced houses.
- Other risk factors include poor protection from solar gains, such as unshaded south and south west facing windows, and east facing windows for rooms occupied in the mornings such as homes of the elderly.
- Light-weight buildings with heavily glazed facades, including flats with lack of access to cool space, may also be vulnerable.

3.1.4 Example 4: Cooling hospital estates and care homes

- Create cooling green spaces in the surrounding environment, with trees, shrubs, trellises, arbours, climbers (though avoid ivy as it can damage buildings), green roofs and water features.
- Do not extend car parks at the expense of green spaces – this adds to surrounding heat. Introduce an active transport plan or car-sharing schemes to reduce the demand for car park spaces (with resulting health benefits to staff and the patients' environment). Plant trees around existing car parks and on top of multi-storey car parks.
- Ensure that buildings are well insulated – both loft and cavity insulation helps to reduce heat build-up (and also reduces carbon emissions and increases energy efficiency).
- Increase opportunities for night-time ventilation either through vents or windows.
- Reflective paint may help on south-facing walls and roofs. This could also be considered for hospital transport – all London buses now have white roofs to reflect heat.

A number of research projects are examining further possible solutions:

- Built Infrastructure for Older People in Conditions of Climate Change (BIOPICCC)
- Design and Delivery of Robust Hospital Environments in a Changing Climate (De2RHECC)

Also refer to the:

- Sustainable Development Unit, especially it's work on Sustainable Development Management Plans (SDMP)

3.2 Towards a longer term strategy for Health and Social Care

Building on the past evaluation of the Heatwave Plan, the recent Health Effects of Climate Change in the UK 2012 and UK Climate Change Risk Assessment reports, and the forthcoming National Adaptation Programme, an emerging agenda for health and social care might be:

Short term (0–5 years)

- Embed the work of heatwave and cold weather planning (excess seasonal deaths) into the new health and social care structures following the passage of the Health and Social Care Act 2012. Multi-agency Local Resilience Forums will have a critical role in the preparations and response to a heatwave, with Health and Wellbeing Boards leading longer term strategic planning to reduce the impact of climate change and ensure maximum adaptation to reduce harm from heatwaves.
- Joint Strategic Needs Assessments (JSNAs) can be used to identify the challenges posed by excess seasonal summer and winter deaths locally, and Joint Health and Wellbeing Strategies (JHWSs) can be used to agree actions to reduce them. These processes, should in turn inform commissioning priorities across the local health and social care system.
- Making progress against several Public Health Outcomes Framework indicators can reduce harm to health from severe heat and heatwaves. For example, provision of green space for exercise/ health reasons (indicator 1.16) can reduce urban heat. Improving social connectedness (1.18) may mean more people are able to access the help they need to protect themselves from severe heat. Addressing air pollution from particulate matter (3.1) and encouraging physical activity (2.13) e.g. walking and cycling will improve air quality (which may worsen during periods of increased temperatures). Lastly, respiratory and cardiovascular diseases are the main causes of illness and death during a heatwave; taking steps to reduce the harm from heat will contribute to improving mortality rates from cardiovascular (4.4) and respiratory diseases (4.7).
- Directors of Public Health should be prepared to take an active role in setting a local agenda.
- Continue to work in partnership with local authorities and social care services to identify vulnerable populations and geographical areas to target long-term planning and interventions during a heatwave as per the Heatwave Plan.
- High temperatures during a heatwave may require affected wards to move patients to cooler areas; extra beds may need to be made available in hospitals due to increased demand.

- Laboratories, pharmaceutical storage and food storage areas in hospitals may be adversely affected by increasing temperatures during heatwaves. Most pharmaceutical products are heat sensitive and start to degrade if stored at higher than room temperature (usually 25ºC). Higher temperatures also increase the risk of food poisoning occurring.
- IT server overheating and disruption to email communication may occur in hospitals and other NHS organisations and providers of NHS commissioned care during heatwaves – incidents have already been reported.
- Encourage transport plans that maximise active and public transport for staff and patients to lower heat generated by motor vehicle use and car parks.

As the UK CCRA 2012 Health Sector Report noted: To be effective, climate change needs to be factored into:

- design, construction and maintenance of healthcare infrastructure;
- allocation of resources;
- procurement processes;
- training programmes;
- business continuity.

Medium term (10–30 years)

- Focus on building design of hospitals and other healthcare establishments to aid passive cooling where possible, and target vulnerable areas (patients, medications, IT) with air-conditioning.
- Review external hospital and health care land for ways to aid cooling – for example, consider constructing underground car parks and maximise green space and trees surrounding buildings.
- Transport planning – to encourage active transport and public transport and use of low-emission vehicles for NHS business.
- Partnership work with local authorities to identify and focus on vulnerable urban areas and populations – for example, certain urban areas may be affected more by high temperatures.
- Monitoring of, and the implications of, new diseases arising due to warmer summer (eg new insect borne diseases not previously endemic in the UK).

Long term (30+ years)

- Planning of new hospitals and health care facilities– ensure maximum green space and water (e.g. lakes) surrounding buildings to aid passive cooling, and avoid building on flood plains.
- Building ’zero carbon‘ hospitals and minimising energy use in the NHS.
- Development of temperature-resistant drugs and laboratory materials.

Implications for other sectors:

A summary of implications for other sectors can be found under the section on Responsibilities at level 4 in the Heatwave Plan.

CHAPTER 4

Further information

4.1 EuroHEAT Project and Heat-Health Action Plan Guidance

The EuroHEAT project, co-funded by the World Health Organization (WHO) and the European Commission, brought together experts from across Europe to share learning in developing national heatwave plans.

Results of this work are summarised in WHO guidance called Heat-Health Action Plans. It explains the importance of the development of heat-health action plans, their characteristics and core elements, with examples from several European countries that have begun their implementation and evaluation.

For more information please visit the Euroheat: Improving Public Health Responses to Extreme Weather/Heat-waves.

More recently the WHO Regional Office for Europe has published information for the general public, health and social care professionals and healthy authorities. Public Health Advice on preventing health effects of heat contains a detailed series of information sheets which can be read in conjunction with this Plan.

4.2 UK Climate Change Risk Assessment 2012 and Health Effects of Climate Change in the UK 2012

For copies of the CCRA Health Sector Report, the CCRA Evidence Report and Devolved Administration Reports, please visit: https://www.gov.uk/government/policies/adapting-to-climate-change

The Health Protection Agency report, Health Effects of Climate Change in the UK is available on the HPA website, pending migration to PHE. http://www.hpa.org.uk/hecc2012

4.3 Other useful references

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