Climate Change and Adaptation

Introduction

Climate change is a large-scale, long-term shift in the planet's weather patterns or average temperatures (Met Office, 2014) and is recognised as potentially the biggest threat to health in the 21st Century (Costello et al, 2009). The Intergovernmental Panel on Climate Change (IPCC)'s report titled 'Climate Change 2014: Impacts, Adaptation, and Vulnerability' says that the effects of climate change are already occurring, and that the world, in many cases, is ill-prepared for risks from a changing climate, such as flooding, sea level rise, storms, higher temperatures, heatwaves and droughts. As the planet continues to warm, heat waves and other weather extremes that happen perhaps once in hundreds of years, if ever, are likely to become the new normal (Potsdam Institute for Climate Impact Research and Climate Analytics, 2014).

The UKCP09 projections show, for the UK:

- Sea level rise in coastal areas;
- More frequent extremes of flooding (more days of heavy rainfall), heat-waves and drought;
- Reduction in frost days and snow cover;
- Milder, wetter winters
- Hotter, drier summers; and
- Greater average warming in the South and less pronounced warming in the Scottish Isles.
- There may be some welcome benefits, but these are likely to be outweighed by a range of negative effects

The UK Government adopted the Climate Change Act in 2008 which meant that the UK was the first country in the world to have a legally-binding long-term framework to cut CO_2 emissions and adapt to climate change. The act commits the UK to reducing emissions by at least 80% in 2050 from 1990 levels and requires the Government to set legally binding 'carbon budgets' which is a cap on the amount of greenhouse gases emitted in the UK over a five-year period. The first four carbon budgets have been put into legislation and run up to 2027.

There is now a growing recognition of the link between climate change and our health and wellbeing. It has become one of the most significant challenges to public health we have ever faced, putting at risk the very pillars of life: clean water, sanitation, air quality and food (Chartered Institute of Environmental Health, 2008).

Many of the impacts of climate change, including those for health, will be felt locally, with effects differing from place to place even though impacts such as heatwaves will have relevance across the country. There are implications for public health, the continuity of health and social care services, the resilience of local emergency services and the impacts on the most socially vulnerable (NHS Sustainable Development Unit, 2012.)

Addressing climate change is synonymous with addressing health inequalities. The Marmot Review report (2011) states that tackling social inequalities in health and tackling climate change must go hand in hand). The IPCC's Working Group 2 Summary for Policy Makers

report states that people who are socially, economically, culturally, politically, institutionally, or otherwise marginalized are especially vulnerable to climate change.

Organisations will need to develop adaptive responses to address both the projected and current impacts of climate change which encompass national guidance and are specific to their local circumstances.

Summary of climate change risks to the health sector (Adaptation Report for the Healthcare System - Executive Summary, 2015):
The risks to the health sector include those to the health of the population, and risks to the delivery of services through changes in service patterns and to the infrastructure. Headline risks include the impact of heatwaves and overheating of buildings, increased risks of air pollution and its associated health effects, and the increasing likelihood of flooding events, alongside impacts on service disruptions and communities. The effects are expected to be unequally distributed, affecting deprived people and groups the most.

The health estate infrastructure is unlikely to be resilient to the changing summer temperatures (particularly as hot summers days are already having an impact on hospital wards) and 9.5% of health care buildings are in flood risk zones. Clearly these impacts also apply to partner services and supply chains which will have a knock on effect on the health of people and the health sector's ability to deliver care.

However, in mitigating for climate change and adapting in preparedness to its impacts on the health and wellbeing of the UK population, exists an opportunity for better individual direct health. Individuals making a shift to a low carbon lifestyle will naturally increase their physical activity levels through more active modes of travel and access green space; will eat more locally produced and seasonal fruit and vegetables. These low carbon lifestyle benefits are known as the health co-benefits of climate change.

What do we know?

Observed Trends in UK Climate
The observed trends in the UK Climate according to the findings of the Health Protection Agency (2012) below are:

- The most recent decade (2002-2011) was warmer than any previous decade on record (e.g. 1992-2001, 1982-1991).
- In the UK, temperatures have been increasing since preindustrial times, and at a rate of around 0.25°C per decade since the 1960s.
- There is no clear trend in annual mean rainfall in the UK, but over England and Wales summer rainfall has decreased and winter rainfall has increased since pre-industrial times.
- There is an increasing trend in the temperature anomalies, and there has been a series of warm years since the late 1980s. 2006 is currently the warmest year on record in the central England temperature (CET).
- As well as changes in mean temperatures, there have been decreasing numbers of cool, and increasing numbers of warm, days and nights between 1960 and 2010. According to the CET:
    - The number of cold days (mean temperature below 0°C) has decreased from

nearly 20 per year in the late 18th century to fewer than 10 per year currently. However, very high variability in the number of cold days exists – for example, compare the winters of 2009 and 2010 with 2005 and 2006.

- The number of hot days (daily mean temperature above 20°C) has increased from fewer than 2 per year in the late 18th century to nearly 5 per year in the present climate. As with cold days, large variability exists, with some years exhibiting over 10 hot days (for example, 1995 had 26 hot days and 2006 had 19 hot days).

In the UK, average sea levels are rising by around 3mm a year; plants and animals are experiencing the earlier onset of spring and summer; winter rainfall is arriving in more intense bursts. In future, scientists expect more severe flooding, more heatwaves in the summer, changes to water availability, and added pressures on the natural environment. These will affect our lives and cause disruption through additional financial and economic costs, and impacts on health and well-being (Committee on Climate Change, June 2015).

Potential Risks and Opportunities for the UK arising from Climate Change

Health and wellbeing threats are linked to temperature extremes, flooding and pollution.

Risks:
A key part of the Government's response to the 2008 Climate Change Act requires a series of assessments of climate risks to the UK, both under current conditions over the longer term. The potential risks and opportunities identified by the Climate Change Risk Assessment - CCRA (HPA, 2012) for the UK arising from climate change are:

1. **Hotter summers are projected to increase the risk of heat-related death and illness.**
   On average, hot weather accounts for around 1,100 premature deaths a year in the UK. Rising temperatures may see an increase in deaths and hospital admissions due to cardio-vascular and respiratory illnesses. By the 2050s, this figure is projected to increase by between 580 and 5,900. Vulnerable groups such as the elderly will particularly suffer from summer overheating as a result of hotter summers. These are defined as daily maximum temperatures in excess of 30°C and minimum temperatures in excess of 15°C over most of a region for at least 5 consecutive days. 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.

   Higher summer temperatures may increase exposure to ultraviolet (UV) radiation and so cause an increase in the incidence and deaths of skin cancer. The large role that human behaviour plays in determining the scale of this threat, such as how well they protect themselves from the sun, makes it difficult to calculate the future level of risk.

2. **The number of casualties due to flooding and the impact of floods on mental wellbeing are both projected to increase.**
   The annual number of flood victims suffering from anxiety, depression or other mental health problems is projected to rise between 4,000 and 7,000 by the 2050s from present day figures of between 3,500 and 4,500. The 18 deaths on average a year currently attributed to direct or indirect flooding and storms are projected to increase by between 6

and 34 by the 2080s. Increase in injuries each year due to flooding and storms is projected to rise by between 270 and 1,380 by the 2080s from the current average of 360 injuries per year. Vulnerable groups (e.g. those affected by poverty, older people, people in poor health and those with disabilities) are at the highest risk (Climate UK, 2012).

3. **Reduction in water availability, particularly during the summer, leading to more frequent water use restrictions and, in the longer term, water shortages.**
   The gap between demand and availability will potentially widen, impacting homes, businesses, schools and hospitals. By the 2050s, between 27 million and 59 million people in the UK may be living in areas affected by water supply-demand deficits (based on existing population levels).

4. **The risk of health problems caused by marine and freshwater pathogens is projected to increase.**
   Rising sea temperatures are already providing conditions conducive to an increase in viruses, bacteria and harmful algae blooms in the seas around the UK. Some of these can have adverse effects on human health (e.g. stomach complaints). As the sea continues to warm, and as sudden and heavy rainfall events generate increased amounts of runoff water into sewers, increasing flooding, the incidence of pathogens may increase.

5. **Health problems caused by air pollution (ground level ozone) may increase.**
   Climate change could lead to a rise in concentrations of ground level ozone (a series of chemical reactions taking place in the presence of sunlight). By 2080s, it is projected that this may lead to respiratory-related deaths to the short term effects of ozone increasing between 650 and 2,900 from the current average of 10,000 a year. Similarly, hospital admissions are projected to rise by the 2080s by between 2,300 and 10,000 from the current figure of around 33,000 a year. Those with pre-existing respiratory illness such as asthma will be at the highest risk.

6. **Food poisoning**
   Climate change could cause about 10,000 extra cases of food poisoning a year in the UK(CIEH, 2008). In fact, there is a strong enough correlation between notified food poisoning, *Salmonella* infections and temperature in the UK to consider public warnings during hot weather. Higher temperatures also increase the rate of infection in animals, multiply bacteria in animal feed and add risk to the food chain. It is highly likely that a majority of these cases will potentially arise from food prepared and cooked at home whether through inappropriate food storage, poor preparation or increased outdoor cooking and eating. There is clearly a need to ensure that public awareness and basic education in simple hygiene is assured and Environmental Health practitioners could play a major role in this (Murphy et al, 2010).

Opportunities:

1. **Milder winters are projected to result in a major reduction in the risk of cold-related deaths and illness.**
   This would particularly benefit vulnerable groups, including those with existing health problems. In an average year, 26,000 to 57,000 deaths and several million patient days

in hospital are currently attributable to cold. Warmer winters may lead to a substantial fall in these figures. By the 2050s, a reduction in these figures of between 3,900 and 24,000 is projected to occur due to increasing average winter temperatures. However, short periods of low temperatures might affect health adversely because people would be less used to cold weather.

2. **Higher summer temperatures may encourage people to spend more time outdoors** It is possible that this may lead to higher levels of vitamin D in the body, improved mental health and achieve the benefits of becoming more physically active.

It is important to note the findings of the Climate Change Risk Assessment 2012 are consistent with the UK Climate Projections (UKCP09).

The Significant Seven: effects of climate change on health, wellbeing, and the health and social care system: (Sustainable Development Unit, 2014)

1. Increased heat related illness and death – increased mortality from respiratory and cardiovascular diseases.

2. Flood related illness and displacement – as well as injury and infection, the effect of flooding on mental health is well documented, and a considerable part of the overall health burden.

3. Increase in food, water and vector borne diseases – an increase in incidences of infections may be seen due to higher temperatures, drought, flooding, changes in habitat and rainfall patterns.

4. Health impacts relating to air quality and aeroallergens– high temperatures are linked to poor air quality with high levels of ozone which are formed more rapidly in strong sunlight; fine particles (PM10, PM2.5) that damage health may also become more prevalent in the future. Climate change may result in earlier seasonal appearance of respiratory symptoms and longer duration of exposure to aeroallergens (e.g. pollen).

5. Skin cancer and sunburn – excessive exposure to UV may have consequences ranging from premature aging of the skin to skin cancer. Malignant melanoma incidence rates in the UK have more than quadrupled over the last thirty years

6. Pressure on health care providers to keep services running in the face of extreme weather – extreme events such as droughts, wildfires and storms may impact on service delivery as they become more common in the future. This includes ability to deliver services in the community.

7. Increase in health inequalities – between different population groups. For example increase fuel and food prices, reduced access to heating, cooling, health services, education and food security.

Possible Regional Impacts of Climate Change:

The East of England has a population of 5.8 million people, 11 per cent of the English total, and it is predicted the region will have 6.8 million residents by 2026, 20 percent more than in 2006. (Sustainability East, 2012)

The UK Climate Change Risk Assessment (DEFRA, 2012) has highlighted three areas that are particularly pertinent to the East of England; these are water scarcity, sea level rise and flooding:

1. **Water Scarcity**
   The East of England region is the driest region in the country. Annual rainfall (600mm average) is only 70 per cent of the national average and less than 20 per cent of the amount that falls in the Lake District.

   The region already faces significant water challenges, most of the East of England is recorded as being over-abstracted or over-licensed at low flows. Where water is being over-abstracted, such as in large areas of Essex and Hertfordshire, unacceptable damage to the environment is already occurring at those low flows.

2. **Flooding**
   An estimated 250,000 properties are at risk of flooding in the East of England, around 8% of the total properties in the region. Properties include households, factories and non-residential properties and warehouses. This is based upon a 1 in 1000 (0.1%) probability in any one year. Also of importance is the effect sea level rise and flood risk poses to critical infrastructure and extensive low lying areas in the region.

   Of the 250,000 properties at risk of flooding, approximately 55,200 properties are at significant risk (1.71% of total properties in the region). These properties are located mainly along the coast, while around 4% of properties are at low flood risk.

3. **Sea level Rise**
   The East is a low-lying area with one-fifth of the region below sea level. There is also some of the fastest eroding coastline in Europe in Norfolk and Suffolk. The specific geology of the coastal areas (clay and sandstone) makes them particularly vulnerable to erosion. It is anticipated that the East of England could face dramatic increases in sea level of up to <0.54m by the end of the century assuming the high UKCP09 emissions scenario.

As a result of warming temperatures over the East of England, the CCRA 2012 has also identified the following key climate risks and implications for the region under 5 categories to raise awareness of the negative influence they may pose to different areas. Under the headings Health and Wellbeing and Buildings and Infrastructure, the following risks and implications are identified:

Health and Wellbeing

- Being one of the warmer parts of the UK, increases in temperature may lead to increased levels of mortality and morbidity due to heat.
- Increased flooding may lead to increased deaths, injuries and people suffering from

mental health effects as a result of flooding. A 0.1% (1:1000) tidal flood in the East of England could occur about 2.4 to 14 times more frequently by the 2080s compared with the present day frequency.
- Increased ozone levels by the end of the century may lead to increased levels of mortality and respiratory hospital admissions.

Buildings and Infrastructure
- The built environment and infrastructure across the East of England is already vulnerable to extreme weather such as flooding, storms, heat waves and droughts.
- Most of today's buildings were designed for the climate that existed when built. They are not necessarily equipped to cope with current and future climates.
- Around 70% of buildings that will be in use in the 2050s already exist.
- Approximately 250,000 properties are at risk of flooding in the East of England, around 8% of the total properties in the region.
- The East of England is one of the most vulnerable regions for changes in water availability, affecting the public, business and industry.
- An increase in subsidence is a significant issue for the East of England, which may pose risks to sections of the transport network and buildings.
- The East of England faces threats associated with increased summer temperatures affecting conditions in buildings and the urban environment. This may lead to heat related damage and / or disruption to energy and transport networks.

Plans to Mitigate the Impacts of Climate Change in Bedford:

Bedford Borough Council's Local Climate Impact Profile 2012
A Local Climate Impact Profile is a resource to enable local authorities to better understand the ways in which they are affected by the weather. The report that was produced involved looking at extreme weather events that have occurred in the Borough over the previous fifteen years and how they have impacted on the local community as well as the council's assets and its capability to deliver services. Bedford Borough has been affected mainly by storms and excessive rain, which can then lead to flooding events as occurred during the Easter floods of 1998 and in 2003, 2007, and in recent years by episodes of snow and drought. The report also highlights the future impacts climate change may cause, as extreme weather is expected to become more frequent and more severe as a result of climate change.

Bedford Borough Council 2012: Local Climate Impact Profile:
www.bedford.gov.uk/environment_and_planning/sustainability/adapting_to_climate_change.aspx

The UK experienced its wettest ever winter during 2013/14 which led to serious floods around the country. This was followed by a record dry September, then a delayed autumn which had the warmest Halloween on record. The Met Office says 2016 is on track to be the warmest year on record since the beginning of the instrumental record in 1850. If confirmed when the final results are compiled at the end of the year, 2016 will be the third consecutive year of exceptionally-high average surface global temperatures. The Met Office has said that research shows current global average temperatures are highly unlikely in a world without human influence on the climate. Human influence has also made breaking the current UK temperature record about ten times more likely.

Local Community Risk Register

Bedfordshire Clinical Commissioning Group (BCCG) and Bedford Borough Council are members of the Bedfordshire and Luton Local Resilience Forum (BLLRF), a statutory body and obligation under the 2004 Civil Contingencies Act (CCA) to bring together Category 1 (Local Authorities, Emergency Services, NHS England, Acute Trusts, Community and Mental Health Trust, Public Health England, NHS Direct, Environment Agency) and Category 2 (BCCG, utilities companies such as water and energy providers, rail) responders for multi-agency co-operation and information sharing, when required to respond to any major emergency in Bedfordshire and Luton.

The CCA requires BLLRF to produce a local Community Risk Register as part of its wider work in preparing for, responding to and recovering from emergencies. The Register covers all types of hazard and all the plans and controls that are in place to protect the community of Bedfordshire and Luton. Government identifies over 80 potential hazards that have to be assessed by the Local Resilience Forum to help prioritise work, which is based upon the hazards identified in the National Risk Register (NRR) of Civil Emergencies (2013). By addressing these hazards, Local Resilience Forums can identify and prioritise hazards locally.

The local 'very high' risks are:

- Flooding
- Pandemic Human Disease
- Severe Weather
- Transport Accidents

To counter these risks, as the lead NHS organisation, Bedfordshire Clinical Commissioning Group has a duty to ensure the co-ordination of the NHS response in an emergency situation, working not only in collaboration with other Clinical Commissioning Groups within Bedfordshire, but with a multi-agency co-operation. This ensures that there is a set trigger point for a response and that co-ordinating groups have met before the real incident. As well as this responsibility, Bedfordshire Clinical Commissioning Group leads on and contributes to plans for several health related hazards which have been identified as presenting a particular risk, namely pandemic influenza, flooding and heat waves.

Pandemic Flu

A pandemic is an infectious disease that spreads worldwide, with outbreaks or epidemics and occurs when a new virus or new virus strain emerges which is markedly different from the previously circulating strains (BLLRF, 2014). Given a lack of immunity to a new strain, everyone will be at risk. Yet some groups may be more at risk than others, but every pandemic is different. Until the virus starts spreading, it is very difficult to predict who these groups might be, and if they differ from those groups more likely to become seriously ill (i.e. the young, those aged 65 and over, those with pre-existing medical conditions, and those immune-suppressed because of treatments or illness) Such numbers could seriously affect the ability of health, emergency services and social care businesses.

The warmer winters as a result of changing climate tend to mean fewer cases of flu, but researchers say this is merely shifting the flu season to a different time of year when people are more vulnerable to it. The season now starts earlier, lasts longer and produces a more

virulent strain of the virus. Populations are less likely to protect themselves against the virus during mild weather, for example by having a flu jab, which makes them more susceptible in the weeks after winter, And when a flu season begins exceptionally early, much of the population has not had a chance to get vaccinated, potentially making that flu season even worse.

The 'Hertfordshire and South Midlands Plan for Infectious Diseases at Pandemic Level: with specific reference for pandemic influenza' outlines the contingency arrangements for Category 1 and 2 Responders to prepare for, respond to and manage the recovery from a pandemic.

Heat Waves
Although not rated as 'Very High' on the Community Risk Register, heatwaves are considered a national problem and locally are considered very likely to occur with a significant impact on the health of the local population.

Bedfordshire Clinical Commissioning Group is the lead organisation of BLLRF during periods of intense heat, and holds its own heat wave plan which is updated annually. The plan sets out arrangements that will apply, and the actions required before and during periods of severe heat, and the preparations both individuals and organisations can make to reduce health risks and includes specific measures to protect at-risk groups in order to reduce both summer deaths and pressures throughout the health and social care system.

Heavy Rainfall and Flooding
Climate change means that flooding is likely to become increasingly common, and could affect both urban and rural parts of Bedford Borough. Localised flooding may occur simultaneously in several places across the county, amounting to a series of major emergencies that may be short term or protracted. Flooding is a major risk for the East of England and BLLRF has a Multi-Agency Flood Plan in place to respond to any flooding incident, which details the roles and responsibilities of each Category 1 responder in Bedfordshire. The plan is designed to be used in the early stages of a flood and deals with the main areas where there is an immediate need for co-operation, joint working and co-ordination. Across Bedford Borough, 2,200 properties are at risk in a 1:1000 flood outline (a flood with a 1 in 1000 annual chance of occurring).

Within the Community Risk Register several types of flooding are classified with having a direct and indirect effect upon Bedford Borough. However, fluvial (river) flooding of the River Great Ouse is considered the primary source of flooding in Bedford Borough. The River Great Ouse passes through the centre of Bedford and through many of the surrounding villages. In addition to the River Great Ouse there is flood risk from the River Til and the Riseley and Pertenhall Brooks to the north of Bedford. The Elstow Brook to the south of Bedford also poses a flood risk. There are also numerous smaller watercourses and ditches that cross Bedford Borough (Environment Agency, 2011).

BLLRF use an online Emergency Log to send alerts and updates to partners. The system was set up in February 2009 for the use of the voluntary sector and emergency volunteers (BLEVEC members) and community emergency groups. Local Authorities, health and emergency service emergency planning officers also have access to the online log and can use it to send and respond to emergency alerts. These include warnings and alerts for

incidents of severe weather such as cold weather, snow, icy roads, heavy rainfall, flooding and heatwaves.

Incidences of flooding in Bedford Borough have been mainly due to surface water flooding, sewers surcharging, or fluvial flooding (where rivers overflow and burst their banks, usually as a result of heavy, intense or prolonged rainfall), and the number of reports of flood related incidents appears to have increased, especially in early 2014 with heavy rainfall at that time. The Environment Agency are working on providing property level protection to 9 properties in Riseley and the Council are involved in providing this level of protection (flood boards for doors, air brick covers and non-return drainage valves etc.) to a total of 8 properties in Yelden and Upper Deane to reduce the risk of flooding from local water courses.

Cold Weather and Fuel Poverty

Extremes of weather, especially cold weather can exacerbate the problems of those experiencing fuel poverty and their ability to keep warm or cool in their homes. A household is considered to be in fuel poverty if:

- they have required fuel costs that are above average
- were they to spend that amount they would be left with a residual income below the official poverty line.

The key drivers behind fuel poverty are:

- the energy efficiency of the property (and therefore, the energy required to heat and power the home
- the cost of energy
- household income

Reducing fuel poverty will help residents to adapt to more extreme, colder weather in winter and warmer temperatures in summer helping them to stay well. Warmer winters due to climate change will mean that the population may be less prepared for more severe cold snaps when they occur.

According to DECC, it is estimated that 6,625 of Bedford Borough's 63,057 households are fuel poor. This is 10.1% of households in the Borough and compares with 10.4% in the whole of England (DECC, 2013).

Those who are particularly vulnerable to cold-related ill health and morbidity are those groups who also typically spend more time at home or need higher temperatures, naturally raising their energy bills. These groups include:

- Older people
- Very young children
- Those with long-term illness or disabilities.

The strongest evidence suggests the health impacts of living in fuel poverty relate to the most serious conditions: cardiovascular and respiratory illness. It is estimated that living at temperatures below 16^{o}C can result in respiratory problems, circulatory problems below 12^{o}C, and below 6^{o}C there is a risk of hypothermia (Marmot Review Team, 2011). The health impacts of living at low temperatures have been examined and documented by the Marmot Review Team (2011).

National & Local Strategies (Best Practices)

National:

The Climate Change Risk Assessment (2012)
Published by Defra (Department for Environment, Food and Rural Affairs), the 2012 Climate Change Risk Assessment (CCRA) sets out the main priorities for adaptation to climate change in the UK. This document represents a key part of the Government's response to the 2008 Climate Change Act, which requires a series of assessments of climate risks to the UK, both under current conditions and over the longer term. Using currently available evidence to produce an initial snapshot of how a changing climate may affect the UK up to the year 2100, it provides an indication of the potential magnitude, when they might become significant and the level of confidence in each finding.

Climate Change Risk Assessment :www.gov.uk/government/publications/uk-climate-change-risk-assessment-government-report

National Adaptation Programme
The National Adaptation Programme sets out a series of actions for key sectors that have been identified as most at-risk from a changing climate, including the health and social care system, in order to be climate ready

National Adaptation Programme:
www.gov.uk/government/uploads/system/uploads/attachment_data/file/209866/pb13942-nap-20130701.pdf

The 2009 UK Climate Projections
Published by Defra, the 2009 UK Climate Projections provides future climate projections for the UK using fifth generation climate change information, latest climate science modelling and climate scientists' best understanding information to predict what the future climate over the UK might look like with the potential risks and opportunities for the UK.

UK Climate Projections (2009): http://ukclimateprojections.defra.gov.uk/21678

Under the Weather - Improving health, wellbeing and resilience in a changing climate.
A partnership between the Department of Health, the NHS Sustainable Development Unit, Public Health England and the Environment Agency have collaborated together to create 'Under the Weather'. This document has been launched by Climate UK. It is an adaptation toolkit for practitioners and decision-makers in the health and care sector. The toolkit aims to encourage action on adaptation and makes the case for the role climate change adaptation plays as a wider determinant of health. The document states in the foreward: 'Climate change is – and will increasingly be – an issue of central importance to the health and wellbeing of local communities' 'Taking action on adaptation will improve the resilience or our services and the communities they serve, lessen the burden of illness and disease, and reduce health inequalities'.

'Under the Weather' (2014):
www.sduhealth.org.uk/documents/publications/Adaptation_Under_the_weather_24_02_14.pdf

Sustainable Development Strategy for the Health and Care System 2014-2020
The strategy was launched in January 2014 and describes the vision for a sustainable health and care system by reducing carbon emissions, protecting natural resources, preparing communities for extreme weather events and promoting healthy lifestyles and environments. Plans.

Public Health England and NHS England - Sustainable Development Strategy: www.sduhealth.org.uk/documents/publications/2014%20strategy%20and%20modulesNewFolder/Strategy_FINAL_Jan2014.pdf

To support the delivery of the strategy, a number of modules have been produced, including one titled: 'Healthy, sustainable and resilient communities': www.sduhealth.org.uk/documents/publications/2014%20strategy%20and%20modulesNewFolder/MODULE_HSRC_FINAL.pdf

Health Effects of Climate Change in the UK (2012)
Published in 2012, the Health Protection Agency's (HPA) Centre for Radiation, Chemical and Environmental Hazards Health Effects of Climate Change is the agency's latest assessment of the threats to UK public health posed by climate change. This report complements the Health Sector report of the 2012 Climate Change Risk Assessment by providing scientific evidence of the wider risks to public health from climate change in the UK. Health Effects of Climate Change (2012): www.gov.uk/government/publications/climate-change-health-effects-in-the-uk.

Public Health Outcomes Framework
The public health outcomes framework sets out the desired outcomes for public health and how these will be measured. The outcomes reflect a focus not only on how long people live but on how well they live at all stages of life whilst simultaneously focusing attention on reducing health inequalities between people, communities and areas.

Public sector organisations with a Board-approved Sustainable Development Management Plan (SDMP) is an indicator which sits within the health protection domain of the public health outcomes framework.

Furthermore, a comprehensive Board approved SDMP founded upon the cornerstones and 10 thematic themes identified in the NHS Carbon Reduction Strategy would cut across and influence additional indicators within the public health outcomes framework; these include:

Domain 1: Improving the wider determinants of health	
Objective: Improvements against wider factors that affect health and wellbeing and health inequalities	
Indicators:	• The percentage of people affected by noise • Utilisation of green space for exercise / health reasons • Fuel Poverty
Domain 2: Health Improvement	
Objective: People are helped to live healthy lifestyles, make healthy choices and reduce health inequalities	
Indicators:	• Diet

	• Excess weight in adults • Proportion of physically active and inactive adults • Self reported wellbeing • Falls and injuries in the over 65s
Domain 3: Health Protection	
Objective: The population's health is protected from major incidents and other threats while reducing health inequalities.	
Indicators:	• Air Pollution
Domain 4: Healthcare public health and preventing premature mortality	
Objective: Reduce numbers of people living with preventable ill health and people dying prematurely, while reducing the gap between communities.	
Indicators:	• Mortality from causes considered preventable • Mortality from all cardiovascular diseases (including heart disease and stroke) • Mortality from Cancer • Mortality from respiratory disease • Hip fractures in over 65s • Excess Winter Deaths

Public Health Outcomes Framework: www.phoutcomes.info/

Adaptation
Guidance published by the Sustainable Development Unit suggests that all Sustainable Development Management Plans should include a section on adaptation to climate change to give Boards assurances to how local risks to the organisation are being managed.

Sustainable Development Management Plans: www.sduhealth.org.uk/delivery/plan.aspx

Regional and Local:

A Summary of Climate Change; Risks for the East of England (2012)
Commissioned by Defra and published by Sustainability East, this document coincides with the UK Climate Change Risk Assessment (2012) and represents the initial interpretation of the England Climate Change Partnership drawing on the CCRA and other local evidence.

A Summary of Climate Change; Risks for the East of England (2012): www.greensuffolk.org/assets/Greenest-County/Adaptation/General/Summary-of-climate-change-risks-to-East-of-England.pdf

Climate Local
The Local Government Association launched a 'Climate Local' initiative which seeks to support and showcase local climate change action.
Climate Local: www.local.gov.uk/climate-local

Bedford Borough Council signed up to Climate Local in 2007 and set out its local commitments and actions which includes encouraging residents to reduce their energy consumption and working on schemes that will alleviate fuel poverty and adapt to climate change:

www.bedford.gov.uk/environment_and_planning/sustainability/climate_local_commitment.aspx

Climate Change Strategy
Bedford Borough Council's Climate Change Strategy 2012/13-2015/16 details the climate change mitigation and adaptation work that has been delivered within the Council and Borough during the previous strategy period.

A revised strategy is being developed to incorporate all aspects of energy and sustainability.

What is this telling us?

The risks identified through the CCRA (2012), the UKCP09 (2012) and the HPA (2012) reinforce the importance of a climate resilient health and social care system to minimise the risks of service failure with knock-on impacts for the wellbeing of the UK population.

Therefore the NHS, health and social care organisations will need to consider how to respond and prepare for the changes ahead. Many of the impacts of climate change will be felt locally, though the effects may differ from location to location. For instance, coastal areas may be subject to significant coastal erosion, while cities may suffer more from the 'urban heat island effect' due to the concentration of buildings in one place. Though impact such as heat waves will have relevance across the country, the health impacts will be greater in Southern England where temperatures rises are predicted to be higher than in the north.

Consequently, organisations will need to develop responses which encompass national guidance and yet are specific to their local circumstances. The local health and social care system is therefore likely to play a crucial role. Adaptation should therefore be addressed alongside mitigation (i.e. action to reduce the emissions of greenhouse gases e.g. carbon dioxide, nitrous oxide, methane, ozone, chlorofluorocarbons) as a means of slowing the rate of human-induced climate change in a twin-track approach to addressing climate change.

Adaptation is to respond to both the projected and current impacts of climate change. Adaptation for the health system is two-fold:

1. Climate change will negatively impact the health and wellbeing of the UK population. The health system needs to be prepared for different volumes and patterns of demand.
2. Climate change could impact the operational delivery of the NHS. The health system infrastructure (buildings, emergency services vehicles, models of care) and supply chain (e.g. fuel, food) need to be prepared for, and be resilient to, adverse weather events.

Adapting to climate change will reduce the costs and damages of a changing climate in the UK from extreme weather events including floods, droughts, and heat waves. Effective adaptation will encourage a better use of resources and can deliver wider health benefits too. For instance, developing green spaces and infrastructure to help prevent overheating while enabling a cooler environment can also help prevent flooding, save energy and promote biodiversity. It can also encourage people to go outdoors, be more active and promote mental wellbeing. Decisions being made now with long-term consequences, such as the commissioning and design of assets and estates, will affect how resilient an organisation will be to the impacts of climate change.

It is likely that the vulnerable groups will suffer most and that those that already experience health inequality will also experience more disturbances from environmental changes. This is clearly of key concern to health and social care organisations who will need to consider how best to support vulnerable people in different scenarios and the models of care that will be best fit for purpose.

Adaptation aligns well with the integrated care agenda and integrated planning and commissioning that Health and Wellbeing Boards are charged with doing.

Adaptation needs to be considered as part of a 'whole systems approach' to sustainable development. Clearly adaptation plans need to support the delivery of existing and future health and wellbeing outcomes as well as local economic and environmental benefits such as those identified in local Joint Strategic Needs Assessments and other local plans and strategies.

Early consideration of adaptation options is essential in identifying the most cost-effective and innovative solutions, allowing organisations the flexibility to act rather than being forced to act urgently and reactively. Early action will avoid being locked-in to long-lived assets such as buildings and infrastructure which are not resilient to the changing climate. This will save costs.

It is important to recognise that adaptation is not a "one-off" event. The way in which organisations adapt will need to be a continual dynamic approach, rather than a single action designed to "solve" a single problem.

NHS organisations already work closely with the wider health and social care system and beyond, involving a wide range of partners including local authorities, voluntary sector, communities and other health and social care providers. The recent health reforms reinforce this partnership working at the local level. A cross-sector approach is essential for the development and delivery of effective adaptation and resilience strategies across the health and social care system. Action to build climate resilience can readily be embedded within established networks and fora such as Health and Wellbeing Boards and existing organisational risk management and business continuity functions.

Strong links exist with the work of emergency planners and links with bodies such as the Local Resilience Fora. Existing cross sector planning agencies can provide the organisational framework for whole system planning and can provide a good forum for this activity. Indeed Health and Wellbeing Boards and emergency planning fora could integrate this agenda into their core plans.

Much of what should be included under adaptation may already be in place in organisations, for example flooding preparedness. It is therefore vital that a dialogue is in place to check alignment with the whole organisation and to ensure longer term planning implications.

What are the key inequalities?

Climate change is already contributing towards a widening gap in health inequalities. Those who have contributed the least in terms of their consumption of natural resources and least able to cope with climate change – older people, people living in areas of higher deprivation,

the sick, and the young, are being hit first, and the hardest. Climate change mitigation strategies are almost synonymous with health improvement (CIEH, 2008).

One example of this is the rapid and exponential price rise in commodities such as fuel and food. It is very likely that we will see increasing numbers of people in our society in both food and fuel poverty as a result of this, along with the adverse health effects that often follow.

Although climate change places a spotlight on health and social inequalities; all society will be affected. This presents us with multiple challenges on how to keep people safe and to work with the wider public health community.

The risks to the health sector include those to the health of the population, and risks to the delivery of services through changes in service patterns and to the infrastructure. Headline risks include the impact of heatwaves and overheating of buildings, increased risks of air pollution and its associated health effects, and the increasing likelihood of flooding events, alongside impacts on service disruptions and communities. The effects are expected to be unequally distributed, affecting deprived people and groups the most (Committee on Climate Change, 2015). Nationally, Bedford Borough is in the mid range on overall deprivation, ranking 148 out of 326 local authorities in England (where 1 is the most deprived) on the 2015 IMD (based on the 'rank of average score'). However this average rating masks pockets of significant deprivation affecting many residents in the urban areas of Bedford Borough.

Of the 103 LSOAs in Bedford Borough, 5 are among the 0-10% most deprived areas in England on the IMD (these are LSOAs in parts of Castle (2), Cauldwell, Harpur and Kingsbrook wards). In 2010 there were 4 LSOAs in the 0-10% decile.

Summary of Projected Impacts of Climate Change on health and vulnerable groups (Bates et al, 2012):

Projected Threats		
	Health Impact	**Vulnerable Groups Affected**
Hotter summers are projected to increase the risk of heat-related death and illness.	↑ Cardiovascular Disease • Coronary Heart Disease • Stroke • Myocardial Infraction ↑ Respiratory Disease ↑ Heat Stroke / Severe Heat Stroke ↑ Skin Cancer ↑ Cataracts ↑ Gastro-intestinal Diseases • ↑ Water-Borne Diseases • ↑ Food-Borne Diseases ↑ Increase of diseases carried by insects and	1. Young People 2. Older People 3. Those with mental health problems 4. Those with disabilities 5. People using Medication 6. Those living in areas of high deprivation due to economic and social factors that prevent measures being taken to cope. (Bates et al, 2012) Increase in thermal illnesses in people whose bodies are unable to regulate

	parasites (Defra, 2012)	temperature.
The number of casualties due to flooding and the impact of floods on mental wellbeing are both projected to increase.	↑ Death ↑ Depression ↑ Anxiety ↑ Other mental health problems ↑ All types of physical injuries ↑ Respiratory Disease (Defra, 2012)	1. Those in Poverty 2. Older People 3. People in poor health 4. Those with disabilities
Reduction in water availability, particularly during the summer, leading to more frequent water use restrictions and, in the longer term, water shortages.	↑ widening in the gap between demand and availability impacting homes and hospitals. ↑ in living areas affected by water supply demand deficits	1. All societies living within these affected areas.
Gastro-intestinal illness including food poisoning and water-borne diseases	↑ Gastro-intestinal conditions • Diarrhoeal diseases • Intestinal illness ↑ Food poisoning • *Salmonella* infections • infection in animals, multiply bacteria in animal feed and add risk to the food chain. (Climate Change Partnership 2012)	1. All Societies
Health problems caused by air pollution (ground level ozone) may increase.	↑ Cardiovascular Disease • Coronary Heart Disease • Stroke • Myocardial Infraction ↑ Respiratory Illnesses ↑ Incidence of Asthma	1. Older People 2. Those with pre-existing respiratory illness such as Asthma. 3. Children residing in areas of low socioeconomic status (Bates et al, 2012)
Projected Opportunities		
	Health Benefit / Consequence	**Vulnerable Groups Affected**
Milder Winters are projected to result in a major reduction in the risk of cold-related deaths and illness.	↓ Seasonal Flu ↓ Cardio-vascular Disease ↓ Respiratory Disease	1. Young People 2. Older People 3. Those with disabilities 4. People using Medication

	Consequence: ↑ Insect-Borne Disease	
Higher summer temperatures may encourage people to spend more time outdoors	↑ Vitamin D uptake ↑Physical Activity levels ↑ Health co-benefits	1. All societies

What should we be doing next?

The report titled 'Adaptation Report for the Healthcare System 2015' (Public Health England and NHS England, 2015.) reports on how the health and care system is adapting to climate change was published in September 2015 following submission to DEFRA.

The report was requested by government under the Adaptation Reporting Power (ARP) component of the Climate Change Act (2008) and was produced by a cross system working group (Department of Health, NHS England and Public Health England). The group was formed to assess how climate change risks are assessed, whether adaptation plans are in place and how the impacts of adaptation plans are evaluated in the following parts of the system:

- Overarching system level
- National Bodies
- Providers (NHS)
- Ambulance Trusts
- Clinical Commissioning Groups
- Community/The Public's Health (Health and Wellbeing Boards)

As part of the National Adaptation Programme7 (NAP) the health sector has set itself two objectives that will help ensure the health system is resilient and adapted to climate change:

- To reduce mortality and morbidity associated with severe weather events and climate change
- To promote resilience and service continuity to ensure sound service delivery.

Report recommendations:

- The sector should consider actions that improve resilience and reduce the likelihood of climate change. These also bring health benefits for individuals, communities and services as well as financial savings.
- The health sector needs to monitor the developing impacts of climate change, the effects on the population and the level of preparedness of services and communities.
- Further support should be given to embed climate change into local thinking and decision making, enhanced by a sound platform of information from nationally collated information and intelligence.
- Coordination and communication of risks and opportunities could be improved.
- Future ARP reports should include social care and more information on the role of small providers and community and voluntary sector.

The NHS Sustainable Development Unit's publication `Adaptation to Climate Change for

Health and Social Care organisations' recommends that health and social care organisations and systems:

1. Draw on existing risk assessments, adaptation tools such as the UKCP09 projections and other local information to assess the risks to the local system
2. Ensure the risks are registered on organisational risk registers
3. Promote dialogue e.g. through a workshop with relevant partners and stakeholders including sustainable development, emergency preparedness, business continuity, finance, estates and clinical leads across the health system and local authorities in order to:
   - help agree co-ordinated action
   - share important information about which climate impacts and parts of the system should be prioritised for adaptation
   - raise awareness across the health and social care sector of the need to adapt services to climate change
4. Agree actions to take forward drawing on cost benefit analysis, across the system and within organisations
5. Assess predicted impacts on vulnerable people, services, models of care and local infrastructures
6. Develop plans or actions that are embedded in the Sustainable Development Management Plan (SDMP) and link to wider heatwave, coldwave, flooding, emergency preparedness and business continuity plans and control measures
7. Develop plans which encompass national guidance, which are specific to local circumstances
8. Review and monitor plans at least annually

This chapter links to the following chapters in the JSNA:
To support the health co-benefits of climate change, the reader is directed to a raft of evidence which can be found within other chapters of Bedford Borough's Joint Strategic Needs Assessment:

- Physical Activity
- Adult Excess Weight
- Children Excess Weight
- Mental Health
- Cancers
- Life Expectancy

References:

Met Office, 2014. *What is climate change*? [online]. Available at: www.metoffice.gov.uk/climate-guide/climate-change [Accessed: 26 February 2014].

Costello A, Abbas M, Allen A, Ball S, Bell S, Bellamy R et al., 2009. *Managing the health effects of climate change*. London: The Lancet, Vol 373, no. 9676, pp.1693—733.

The Intergovernmental Panel on Climate Change (IPCC) Working Group II contribution to the Fifth Assessment Report, 2014. *Climate Change 2014: Impacts, Adaptation, and Vulnerability.* Available at: http://ipcc-wg2.gov/AR5/report/ [Accessed: 21 October 2015].

Potsdam Institute for Climate Impact Research and Climate Analytics, November 2014. *World Bank Report: Turn Down the Heat [online].* Available at: www.worldbank.org/en/topic/climatechange/publication/turn-down-the-heat [Accessed: 08 December 2014].

UK Climate Projections. 2012. *What is UKCP09?* [online]. Available at: http://ukclimateprojections.defra.gov.uk/21678 [Accessed: 27 February 2014].

Chartered Institute of Environmental Health, November 2008. Climate Change, Public Health and Health Inequalities: A resource for environmental health practitioners (abridged version) [online], Available at: www.cieh.org/library/Policy/Publications_and_information_services/Policy_publications/Climate_Change_Public_Health_Health_Inequalities.pdf [Accessed: 15 October 2015].

NHS Sustainable Development Unit, August 2012. *Adaptation to Climate Change for Health and Social Care organisations, Co-ordinated, Resilient, Prepared* [online]. Available at: www.sduhealth.org.uk/documents/publications/adaptation_guidance_final.pdf [Accessed: 15 October 2015].

Marmot Review Team, 2011. *The Health Impacts of Cold Homes and Fuel Poverty*. Available at: http://www.instituteofhealthequity.org/projects/the-health-impacts-of-cold-homes-and-fuel-poverty [Accessed: 21 October 2015].

The Intergovernmental Panel on Climate Change (IPCC) Working Group II contribution to the Fifth Assessment Report, 2014. *Climate Change 2014: Impacts, Adaptation, and Vulnerability – Summary for Policy Makers.* Available at: http://ipcc-wg2.gov/AR5/images/uploads/WG2AR5_SPM_FINAL.pdf [Accessed: 21 October 2015].

Public Health England and NHS England. 2015. *Adaptation Report for the Healthcare System 2015. Executive Summary.* Available at: www.sduhealth.org.uk/areas-of-focus/community-resilience/adaptation-report.aspx. [Accessed: 19 October 2015].

Health Protection Agency, 2012. *Health Effects of Climate Change in the UK 2012. Current evidence, recommendations and research gaps*.

Committee on Climate Change. 2015. *Reducing emissions and preparing for climate change: 2015 Progress Report to Parliament- Summary and recommendations. Available at: www.theccc.org.uk* [Accessed: 02 October 2015].

Health Protection Agency, 2012. *Health Effects of Climate Change in the UK 2012. Current evidence, recommendations and research gaps*.

Climate UK. 2012. A summary of climate change: Risks for the East of England. Cambridge: East of England Climate Change Partnership [pdf]. Available through: www.greensuffolk.org. www.greensuffolk.org/assets/Greenest-County/Adaptation/General/Summary-of-climate-change-risks-to-East-of-England.pdf [Accessed 21 October 2015].

Chartered Institute of Environmental Health, 2008. *Climate Change, Public Health and Health Inequalities - A resource for environmental health practitioners.* Available at:

www.cieh.org/library/Policy/Publications_and_information_services/Policy_publications/Climate_Change_Public_Health_Health_Inequalities.pdf. [Accessed: 21 October 2015].

Murphy, J, Sexton, D, Jenkins, G, Boorman, P, Booth, P, Brown, K, Clark, R, Collins, M, Harris, G, Kendon, L and Met Office Hadley Centre., 2010. *UK Climate Projections science report: Climate change projections*. Met Office Hadley Centre, Exeter.

UK Climate Projections, 2012. *What is UKCP09?* [online]. Available at: http://ukclimateprojections.defra.gov.uk/21678 [Accessed: 27 February 2014].

Sustainable Development Unit, 2014. *Under the Weather - Improving health, wellbeing and resilience in a changing climate*. Available at: www.sduhealth.org.uk/documents/publications/Adaptation_Under_the_weather_24_02_14.pdf [Accessed: 21 October 2015].

Climate UK. 2012. A summary of climate change: Risks for the East of England. Cambridge: East of England Climate Change Partnership [pdf]. Available through: www.greensuffolk.org. www.greensuffolk.org/assets/Greenest-County/Adaptation/General/Summary-of-climate-change-risks-to-East-of-England.pdf [Accessed 21 October 2015].

Defra, 2012. *Climate Change Risk Assessment.* Available at: www.gov.uk/government/publications/uk-climate-change-risk-assessment-government-report [Accessed: 21 October 2015].

Bedford Borough Council 2012, *Local Climate Impact Profile*: www.bedford.gov.uk/environment_and_planning/sustainability/adapting_to_climate_change.aspx [Accessed: 03 April 2014].

Bedfordshire and Luton Local Resilience Forum. 2014. *What would you do if?* [online]. Available at: www.bllrf.org.uk/home [Accessed: 26 February 2014].

Bedfordshire and Luton Local Resilience Forum. 2014. *Pandemic Risk and Plan* [online]. Available at: www.bllrf.org.uk/content/?id=184 [Accessed: 27 February 2014).

Department of Health, 2005. *Pandemic flu: important information for you and your family* (October 2005 edition). [online]. Available at: http://webarchive.nationalarchives.gov.uk/20081023143640/dh.gov.uk/en/publicationsandstatistics/publications/publicationspolicyandguidance/dh_4121631 [Accessed: 26 February 2014]

Bedfordshire and Luton Local Resilience Forum. 2014. *Pandemic Risk and Plan* [online]. Available at: www.bllrf.org.uk/content/?id=184 [Accessed: 27 February 2014).

Environment Agency, 2011. *Great Ouse Catchment Flood Management Plan*. Peterborough, Environment Agency.

Department of Energy and Climate Change, 2013. *Annual Report on Fuel Poverty Statistics 2013*

Department of Energy and Climate Change, 2013. *Sub-Regional Fuel Poverty Data.*

Climate UK. 2012. *A summary of climate change: Risks for the East of England. Cambridge: East of England Climate Change Partnership* [pdf]. Available through: www.greensuffolk.org. www.greensuffolk.org/assets/Greenest-County/Adaptation/General/Summary-of-climate-change-risks-to-East-of-England.pdf [Accessed 21 October 2015].

Defra, 2012. *Climate Change Risk Assessment.* Available at: www.gov.uk/government/publications/uk-climate-change-risk-assessment-government-report [Accessed: 21 October 2015].

Defra, 2013. *The National Adaptation Programme - Making the country resilient to a changing climate*. Available at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/209866/pb13942-nap-20130701.pdf [Accessed: 21 October 2015].

UK Climate Projections, 2012. *What is UKCP09?* [online]. Available at: http://ukclimateprojections.defra.gov.uk/21678 [Accessed: 27 February 2014].

Sustainable Development Unit, 2014. *Under the Weather - Improving health, wellbeing and resilience in a changing climate*. Available at: www.sduhealth.org.uk/documents/publications/Adaptation_Under_the_weather_24_02_14.pdf [Accessed: 21 October 2015].

Public Health England and NHS England, 2014. *Improving health, wellbeing and resilience in a changing climate - A Sustainable Development Strategy for the NHS, Public Health and Social Care system.*

Public Health England and NHS England, 2014. *Sustainable, Resilient, Healthy People & Places. Module: Healthy, sustainable and resilient communities.*

Health Protection Agency, 2012. *Health Effects of Climate Change in the UK 2012. Current evidence, recommendations and research gaps*.

Public Health Outcomes Framework [online] www.phoutcomes.info/ [Accessed: 21 October 2015].

Sustainable Development Management Plans. Available at: www.sduhealth.org.uk/delivery/plan.aspx. [Accessed: 21 October 2015].

Climate UK. 2012*. A summary of climate change: Risks for the East of England. Cambridge: East of England Climate Change Partnership* [pdf]. Available through: www.greensuffolk.org. www.greensuffolk.org/assets/Greenest-County/Adaptation/General/Summary-of-climate-change-risks-to-East-of-England.pdf [Accessed 21 October 2015].

Bedford Borough Council's Climate Local Commitments. [online] www.bedford.gov.uk/environment_and_planning/sustainability/climate_local_commitment.aspx [Accessed 21 October 2015].

Bedford Borough Council's Climate Change Strategy (2012/13-2015/16). [online] http://www.bedford.gov.uk/environment_and_planning/sustainability/what_is_the_council_doing/climate_change_strategy.aspx [Accessed 21 October 2015].

Climate UK. 2012. *A summary of climate change: Risks for the East of England. Cambridge: East of England Climate Change Partnership* [pdf]. Available through: www.greensuffolk.org. www.greensuffolk.org/assets/Greenest-County/Adaptation/General/Summary-of-climate-change-risks-to-East-of-England.pdf [Accessed 21 October 2015].

Chartered Institute of Environmental Health, 2008. *Climate Change, Public Health and Health Inequalities - A resource for environmental health practitioners.* Available at: www.cieh.org/library/Policy/Publications_and_information_services/Policy_publications/Climate_Change_Public_Health_Health_Inequalities.pdf. [Accessed: 21 October 2015].

Committee on Climate Change. 2015. *Reducing emissions and preparing for climate change: 2015 Progress Report to Parliament- Summary and recommendations. Available at: www.theccc.org.uk* [Accessed: 02 October 2015].

Bates, G, Chadborn, N, Jones, L, McVeigh, J., 2012. *The impact of climate change upon health and health inequalities in the North West of England*. North West Public Health Observatory: Liverpool John Moores University.

Public Health England and NHS England. 2015. *Adaptation Report for the Healthcare System 2015. Executive Summary.* Available at: www.sduhealth.org.uk/areas-of-focus/community-resilience/adaptation-report.aspx. [Accessed: 19 October 2015].

NHS Sustainable Development Unit, 2012. Adaptation to Climate Change for Health and Social Care organisations. Available at: *www.sduhealth.org.uk/documents/publications/Adaptation_Guidance_Final.pdf* [Accessed: 03 December 2014]