London Climate Change Partnership
Health and Social Care Risk Assessment and Action Plan

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Date: 31 March 2010

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Abbreviations and acronyms

BAME ..... Black, Asian and Minority Ethnic
CCAS ..... Climate Change Adaptation Strategy
CCS ..... Civil Contingencies Secretariat
CLG ..... Communities and Local Government
CQUIN ..... Commissioning for Quality and Innovation
CSL ..... Commissioning Support for London
DDA ..... Disability Discrimination Act
DEFRA ..... Dept for Environment, Food and Rural Affairs
DfT ..... Department for Transport
DH ..... Department of Health
ECDC ..... European Centre for Disease Prevention and Control
FT ..... NHS Foundation Trust
GIS ..... Geographical Information Systems
GLA ..... Greater London Authority
GOL ..... Government Office for London
HACCP ..... Hazard Analysis and Critical Control Point
HfL ..... Healthcare for London
HGV ..... Heavy Goods Vehicle
HIA ..... Health Impact Assessment
HPA ..... Health Protection Agency
ICP ..... Integrated Care Pathway
ICPC ..... Intergovernmental Panel on Climate Change
JIP ..... Joint Improvement Partnership
JSNA ..... Joint Strategic Needs Assessment
LAA ..... Local Area Agreement
LCCP ..... London Climate Change Partnership
LDF ..... Local Development Framework
LHC ..... London Health Commission
LRAP ..... Local and Regional Adaptation Partnership Board
LSCBs ..... Local Safeguarding Children Boards
LSDC ..... London Sustainable Development Commission
LSPs ..... Local Strategic Partnerships
LTP ..... Local Transport Plan
LVSC ..... London Voluntary Service Council
NHS ..... National Health Service
NHSL ..... NHS London
PCTs ..... Primary Care Trusts
RPHG ..... Regional Public Health Group
RAAS ..... Risk Assessment and Action Plan
RIEP ..... Regional Improvement and Efficiency Partnership
SOA ..... Super Output Area
SSSI ..... Site of Special Scientific Interest
TfL ..... Transport for London
UHI ..... urban heat island
UKCIP ..... UK Climate Impacts Programme
WHO ..... World Health Organization

1. Executive summary

1.1 The London Climate Change Partnership (LCCP) works with stakeholders to help ensure London is prepared for climate change. LCCP has supported the development of the Mayor's Climate Change Adaptation Strategy (CCAS), of which the consultation draft was published in February 2010.

1.2 The CCAS recognises that climate change impacts present not only risks but also opportunities for health (physical and mental), health inequalities and service provision (health and social care). Proposed Actions 28 and 29 in the Strategy are to undertake a sector-specific assessment of these positive and negative impacts and ensure that they are addressed in the capital refurbishment programme and in the design of services.

1.3 This report was commissioned by the LCCP to help deliver on these actions. It aims to improve: understanding of the key London-specific risks to Londoner's health and health/social services' delivery; understanding of where responsibilities for adapting London's health and social sector lie; the ability to mainstream adaptation into the business planning of relevant organisations; understanding of the risks faced by the hospital refurbishment programme and commissioning of services.

1.4 The work was carried out over a period of one month (March 2010) and combined desk research with semi-structured interviews with strategic stakeholders. The report contains an organogram of health and social care responsibilities in London; a summary of direct and indirect impacts on health; and a summary of key issues and recommendations to central, regional and local organisations.

1.5 The written report is supported by a bespoke online application *Climate Risk Mapper*. This presents instant access to data helping to visualise the locations of health and social care provisions in the context of projected climate change risks.

1.6 The report takes as its starting point the climate change impacts anticipated in the CCAS, namely, flooding, drought and overheating. These have consequences for individual and population health (mental and physical), quality of life, community resilience, the environment, productivity and the economy, infrastructure and service provision.

1.7 These impacts are considered in the context of the nature of London's population and its health, the individual and wider social, cultural, economic and environmental factors which determine this, and the key regional strategy for health and social care provision, *Healthcare for London* (HfI). Account is also taken of other relevant strategies and policies, notably *Saving carbon, improving health: the NHS carbon reduction strategy for England*.

1.8 HfI focuses on "improving quality and productivity by: improving health, creating better access to care closer to home and improving quality and safety by centralising specialist hospital services where necessary." The opportunities and risks presented by the relocation or redesignation of specific facilities and the new approach to designing and delivering integrated care pathways or ICPs are examined.

1.9 Health and social care services are vital to protecting and improving population and individual health, but are only one part of the overall picture. There are many factors outside health and social care that affect health, including individual and population responses to climate change and weather. These also determine inequalities in health across the population and between groups.

1.10 Climate change will exacerbate existing health inequalities and may lead to new health needs. Measures to increase climate change resilience amongst London's population are consistent with the Mayor's *London Health Inequalities Strategy*.

1.11 Effective adaptation will be based on an understanding of how individuals and populations respond differently. It will span contingency planning and the ways in which information, advice and support are made available. It is necessary to enhance knowledge of the relevant

needs of vulnerable and so-called hard to reach groups, and to target measures accordingly. Given the range of determining factors and the complex and dynamic profile of London's population, partnership and multi-agency responses will be required. In particular, the sharing of data, analysis and experience between health, social care, and environmental stakeholders.

1.12 Observed and predicted changes to London's climate pose risks and opportunities for the provision of and demand for health and social care services. They do so directly, such as a flood preventing access to a hospital, and indirectly, such as by creating economic stresses and pressures which in turn affect human health and the resourcing of services.

1.13 Many direct climate risks have largely predictable implications for the provision of healthcare through their impact on the locations where services are provided. Social care is not so easily or comprehensively identified in this way because services are delivered in diverse and dispersed locations and in many cases, and increasingly, at home.

1.14 Some climate changes are less predictable or will occur with more subtlety. There is a risk that their health impact is not fully anticipated, meaning that the collection and sharing of data to enable more sophisticated mapping of risk should become a high priority.

1.15 Climate risks need to be understood, with respect to flood, drought and overheating, in relation to the location of services and access to them, the supply chains which service them, impact on energy and ICT requirements, the location and mobility of service users themselves, the availability of drinking water, air quality, and availability of fresh food.

1.16 Emergency planning should be informed by climate change projections, particularly the increased incidence of extreme weather events.

1.17 The creation of polyclinics, a key feature of the *Healthcare for London* vision, provide manifold opportunities for enhancing service and community resilience; also for realising co-benefits for health and climate change mitigation, and increased efficiency.

1.18 The Long-Term Conditions (LTC) care pathway provides a case study for how climate change adaptation can readily be built into the design and commissioning of all the new HfI pathways. Evidence suggests that the best practice for LTC management is similar across the major disease conditions. The pathway and best practice indentified by the Long-Term Conditions Clinical Working Group are tested for sensitivity to changes in climate. Clinical engagement can be further harnessed to develop and promote good practice in climate change adaptation.

1.19 The importance of surveillance and real-time information, such as AIRTEXT for patients and professionals is underlined. This will require further training, awareness-raising and resources.

1.20 In general, adaptive actions should be targeted at vulnerable and marginalised groups, with assertive outreach often the most appropriate means. This is supported by the Integrated Impact Assessment (IIA) previously carried out with respect to *Healthcare for London*, although this did not include a specific focus on climate change.

1.21 The report's conclusion and recommendations are based on the evidence presented, and supplemented with knowledge and experience of the planning, development and assurance processes followed by regional and local government and the NHS.

1.22 The recommendations are the building blocks for an Action Plan which will require cross-sector expertise and sign-up at the highest level. Such an Action Plan will be timely in approaching the season for refreshing Joint Strategic Needs Assessments (JSNAs), community strategies and, later, commissioning strategies.

1.23 There are complementary roles for policy and development bodies, assurance and regulatory bodies, statutory and non-statutory bodies, local commissioners and providers.

1.24 At a national level, the Department of Health's Climate Change Plan has identified four strategic risks which it is recommended should inform London's Action Plan also. These are:

- Local service planning and design do not take climate change evidence and impacts into account.

- Provision of local health services does not match demand for increased range/type/scale of diseases.
- Resources are not prioritised and allocated effectively to take account of climate change evidence and impacts.
- Policy development design does not take climate change evidence and impacts into account.

1.25 The report's recommendations are grouped around the following themes:

- Awareness raising and key messages
- Data mapping and surveillance
- Clinical engagement, commissioning and service design
- Service standards
- Built environment
- Emergency planning
- Capacity-building and workforce development
- Procurement.

2. Introduction

The brief

2.1 The London Climate Change Partnership (LCCP) aims to ensure London is prepared for climate change. The Partnership works with strategic stakeholders to help them build adaptation considerations into their planning and operations and has supported the development of the Mayor's Climate Change Adaptation Strategy (CCAS), of which the consultation draft was published in February 2010 (1).

2.2 Climate impacts on health, direct and indirect, are recognised in the CCAS and are also referenced in the Mayor's Health Inequalities Strategy (3). Both strategies are due to be finalised later in 2010. Taken together, they provide the basis for concerted action to address the range of climate impacts on health, health inequalities and health and social care services.

2.3 The CCAS recognises that climate change impacts present not only risks but also opportunities for health (physical and mental), health inequalities, and service provision (health and social care). Proposed Actions 28 and 29 in the strategy are to undertake a sector-specific assessment of these positive and negative impacts and ensure that they are addressed in the capital refurbishment programme and in the design of services.

2.4 The LCCP, therefore, commissioned a Risk Assessment and Action Plan (RAAS) with the following desired outcomes:

- A better understanding of the key London-specific climate risks to Londoner's health and health/social services' delivery.
- An improved understanding of where responsibilities for adapting London's health and social sector lie.
- An improved ability to mainstream adaptation into the business planning if relevant organisations.
- A better understanding of the risks that the hospital refurbishment programme and new commissioning of health services face and should address.

2.5 In order to achieve these, we were asked to deliver the following outputs:

- A short report containing
    - An organogram of health and social care responsibilities in London.
    - A summary of direct and indirect impacts on health.
    - An overlay of adaptation responsibilities in London's health and social care sector.
- A map and database showing the key health sector buildings in London (an electronic database and maps, mapping health services against flood risk and the urban heat island (UHI), making linkages and establishing risk status).
- A summary of key issues and a set of prioritised recommendations to central, regional and local level health sector organisations, with SMART actions where appropriate.

2.6 The work was carried out over a period of one month (March 2010) and combined desk research with semi-structured interviews of strategic stakeholders including members of the project steering group which is co-ordinated by the LCCP secretariat. A list of interviewees and those who provided informal advice is provided as Appendix 1.

Climate Risk Mapper

2.7 This written report is supported by a bespoke online application *Climate Risk Mapper.* This provides instant access to data helping to visualise the locations of health and social care provision in the context of projected climate change risks.

2.8 To access the application, please visit http://beta.geofuturesonline.com/GLA and enter the login details you have been given (if necessary, contact the authors).

2.9 For detailed instructions, see Appendix 2.

Assumptions

2.10 We took as our starting point the climate change impacts anticipated in the CCAS, namely, flooding, drought and overheating. These have consequences for individual and population health (mental and physical), quality of life, community resilience, the environment, productivity and the economy, infrastructure and service provision.

2.11 The direct health impacts of climate change are already in evidence, particularly on more vulnerable groups, such as the increase in deaths of older people during heat waves (4). Additionally, the environmental contribution to health inequalities is well documented as one of the determinants of health, with climate change exacerbating the health problems of, for example, people living in poor quality and badly insulated housing (5).[1]

2.12 While some impacts are more immediate and sometimes dramatic *i.e.* extreme weather events requiring, in the first instance, an emergency response; others are longer-term and less obvious such as the introduction of new vector-borne diseases not yet familiar to GPs, or food hygiene issues as a result of warmer weather overall. The longer-term health effects of weather disasters are also significant.

2.13 For the health and social care sectors, therefore, the response to climate change needs to encompass adaptive strategies spanning prevention, emergency response, recovery and rehabilitation. It also needs to take into account whole population needs, health inequalities, the distinct needs of specific vulnerable groups, and equitable access to services. There may be additional health gains to be made where actions to adapt to and mitigate climate change are integrated.

2.14 Our report considers risks and strategic responses encompassing short and long-term, direct and indirect impacts on health and on health and social care services.

National context

2.15 The Department of Health is responsible for policy, standards and priorities for the NHS and for policy and guidance for social care. However, the lead responsibility for social care at a local level sits with local authorities which are answerable not to DH but to the Department of Communities and Local Government.

2.16 The Climate Change Act (2008) (6) has set in train a range of policies and strategies to mitigate climate change and adapt to its effects. In July 2008, the Government published *Adapting to Climate Change in England: A Framework for Action* (7). Under the auspices of DEFRA, the Adapting to Climate Change Programme is leading work across Government to prepare for a changing climate, including coordinating and driving delivery of Departmental Adaptation Plans.

2.17 To date, the emphasis of the NHS has been on climate change mitigation, driven by *Saving Carbon, Improving Health: NHS Carbon Reduction Strategy for England* (8), but the new Climate Change Plans start to redress the balance by committing to more adaptive actions. This includes a recognition that Care Closer to Home – central to the NHS Next Stage Review (9) – presents opportunities for designing community based facilities and services which are adapted to a changing climate.

[1] It is worth noting that what are understood to be direct or indirect climate impacts in a general sense can both have direct impacts on health specifically. For example, flooding is a direct climate impact which can have direct health effects such as the spread of water-borne diseases (or indeed death by drowning). Flooding can also have an indirect impact on food supply if crops are spoiled, potentially leading to a direct health impact through poor nutrition.

2.18 As stakeholders at a local level in Local Strategic Partnerships, NHS organisations – notably Primary Care Trusts – are party to Local Area Agreements and contributors to targets defined by the National Indicator set.

2.19 National Indicators 185 and 186 require local authorities to reduce their CO_2 emissions and those across their area. Alongside these, National Indicators 187 and 188 focus on fuel poverty and climate change adaptation, respectively, and NI 189 on flood and coastal erosion risk management. Technically distinct, these nonetheless invite integrated strategies which ensure community and service resilience.

2.20 Taking this more holistic approach, the DH Sustainable Development Action Plan (2009-2011) (10) does include some adaptation commitments, notably in relation to social care via the Sustainable Social Care programme (11) which aims to encourage commissioners of adult services to respond to climate change (via both mitigation and adaptation).

2.21 However, the environment and climate change are entirely absent from *Putting People First* (12), the DH vision document for transforming adult services.

2.22 A key finding of the Sustainable Social Care programme (unpublished interim reports; final reports forthcoming 2010) is that the local authority corporate commitment to sustainable development and climate change priorities has not yet translated into social care planning or delivery. There are some individual exceptions, of course, but these have largely been driven by environment and climate change teams and are also mainly at the planning and aspirational stage rather than delivery – which requires ownership by the health and social care sectors themselves. Examples of local authorities which have made some advances are Hampshire (13) and Hertfordshire (13). The London Borough of Islington and NHS Islington have established a working group to scope possible action in relation to health and social care.

2.23 Similarly, regions such as East Midlands and West Midlands have analysed health impacts within their climate change strategies, but have yet to progress action within the sector itself.

2.24 On 31st March 2010 individual Government Departments published the aforementioned Adaptation Plans, setting out their key risks and priorities on climate change, and Carbon Reduction Delivery Plans (work led by Department of Energy and Climate Change). Departments were encouraged to take a joint approach and some have produced combined Climate Change plans including the Department of Health.

2.25 The priority areas identified in the Department of Health's Climate Change Plan (14) are:

- Built environment
- Service design and delivery
- Information Communication Technology
- Workforce
- Knowledge and research
- Finance
- Procurement.

2.26 These priorities are variously reflected in this report.

London context

2.27 Against this national backdrop, and by comparison with other regions, London's health and social care sectors, and their local authority partners, are no more advanced in implementing climate adaptation strategies or integrating adaptation into mainstream health and social care business – although the commissioning of this report is an important and positive step.

2.28 Interviews with regional stakeholders in public health, adult and children's services, NHS commissioning support, 2012 Olympic and Paralympic Games, and emergency planning confirmed that climate adaptation has simply not been on the agenda for planning, development, delivery or quality assurance of services.

2.29 Emergency planning does, of course, address the risks associated with individual extreme weather events, but the changing risks in light of incremental climate change have not yet been considered.

2.30 In light of this, we suggest the need for actions to raise basic awareness among strategic and frontline staff of climate change adaptation and to set out the case in terms of London's health, healthcare and social care priorities.

2.31 More positively, mitigation and carbon reduction do now have their place in London's health and social care sectors, which can provide the entry point for discussions around adaptation, particularly where mitigation and adaptation co-benefits can be identified such as through building programmes or public health initiatives to promote active travel.

2.32 The NHS is committed to developing a London-wide Carbon Reduction Strategy and has put in place the infrastructure to drive this, with senior executive and non-executive representation from the NHS and partner organisations. Similarly, London Councils is discussing with regional partners the idea of a shared platform for addressing climate change, and this has the potential to include adaptation as well as mitigation considerations.

2.33 *Healthcare for London* (HfL) is a ten year programme to transform healthcare and standards of health in the capital. Building on Lord Darzi's 2007 report *A Framework for Action* (15), HfL has led to the rationalisation of major trauma and stroke services and the development of local polysystems comprising new and redesigned facilities integrating health, social care and other community facilities. A set of new care pathways has been defined with a greater emphasis on prevention and self-management of care, particularly in relation to Long Term Conditions. We examine the opportunities represented by *Healthcare for London* in this report, and offer suggestions for how climate adaptation can be incorporated into the design, commissioning and delivery of care pathways at a local level.

2.34 As members of the London Climate Change Partnership, London's regional health and social care organisations have made a strategic commitment to support action to adapt to climate change.

2.35 The same organisations work together and separately in partnership with the Greater London Authority (GLA) to help deliver the duties and powers in the Greater London Authority Acts of 1999 and 2007 with regard to health, health inequalities, climate change and sustainable development (for example via the London Health Commission).

2.36 We, therefore, identify opportunities distinct to London for the health and social care sector to adapt to climate change by supporting and drawing on the support of regional stakeholders across sectors.

Adaptation and health

2.37 There are a range of approaches to climate change adaptation on which the health and social care sectors could usefully draw. Effective adaptation addresses both the current health risks of climate change and how these risks are likely to change in the future (16). The European Centre for Disease Prevention and Control (ECDC) recommends that representatives of all potentially affected groups should be included in an adaptation assessment to ensure that

- all possible options are identified;
- they provide input into prioritizing options for immediate action; and
- to increase community buy-in for the options implemented.

2.38 However there is no dominant view on how this or other approaches could or should be adopted.

Service provision, climate change and inequalities: general principles

2.39 Climate change will adversely affect marginalised groups and is expected to increase health, and other, inequalities (17;18). *Healthcare for London* (19) projects future demand for, and provision of, health and social care services. It sets targets for the period 2010 to 2015 . These projections and targets currently assume that the climate in London is a constant. While this is appropriate over the next five years it is clear that a longer term perspective needs to be developed and that climate needs to be considered as a variable in projections for health and social care services.

2.40 The Integrated Impact Assessment (IIA) of *Healthcare for London* (20) advised that commissioning decisions need to take account of, and to take steps to reverse, the inverse care law (21). People, and groups, who are marginalised or who have a lower socio-economic status tend to have lower usage of primary care and thus present later to healthcare services and have poorer outcomes. Apart from the fact that this maintains low levels of health, it is an inefficient and resource intensive way of using healthcare services.

2.41 It is very important to ensure that proactive and intelligent outreach to marginalised groups and to communities newly settled in London becomes a core part of service delivery and that this includes steps to strengthen resilience in the face of climate change impacts.

2.42 We have considered the recommendations made in the IIA of Healthcare for London (20;22). See Chapter 6 *How will the care pathways adapt?*

3. Health in London and climate change

3.1 Health includes physical, social and psychological wellbeing (23). Population health is a primary goal of sustainable development (24) and reducing inequalities in health is a cross-cutting duty for the Mayor (3).

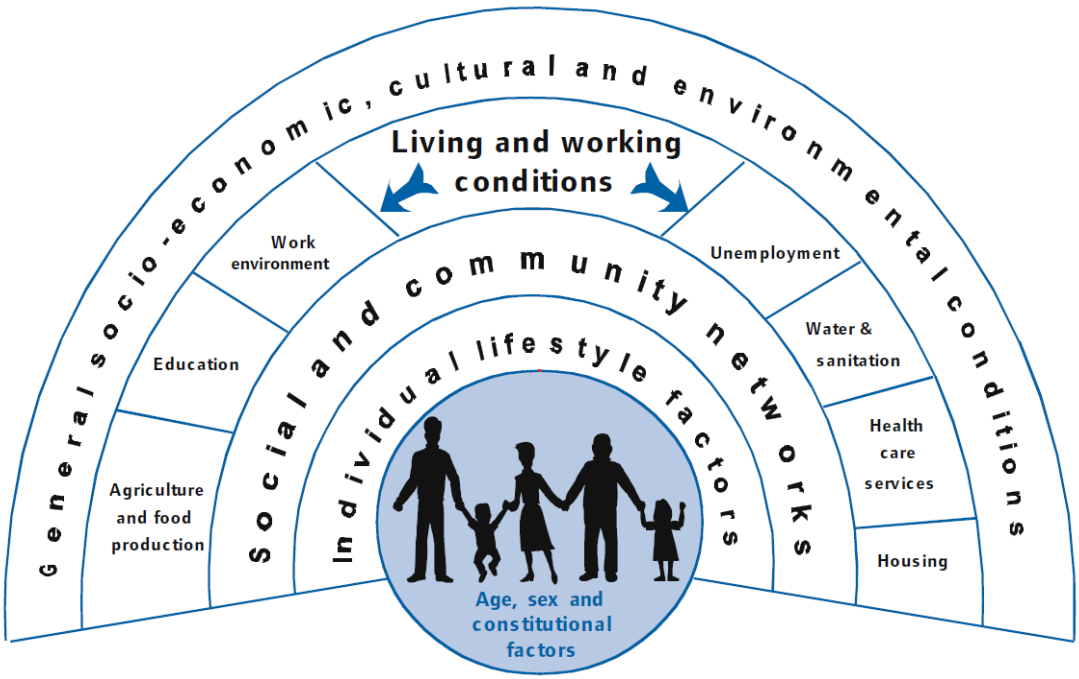
3.2 In this section we do not revisit ground covered expertly in other reviews of climate change and health (1;2;24-27). For full analysis we refer the reader to these documents. Here we wish to establish the main links for London between a changing climate, human health and health inequalities. This will lead into a consideration of the implications for adaptation for the health and social services in London.

3.3 In the following paragraphs we consider what we mean by health, we then look at London's population and we finish by summarising the links between climate and health. We look at the extreme weather events, heatwaves and flooding, and conclude with examination of the longer-term effects of climate change on the wider determinants of health.

Human health is more than health services

3.4 Health and social care services are vital to protecting and improving population and individual health however they are one part of the overall picture. Figure 1 shows that there are many factors outside health and social care that affect health. The CCAS (1) recognises the role that factors external to health and social care play in maintaining and improving human health.

Figure 1: Social determinants of health



Dahlgren and Whitehead (28) cited in GLA (3)

Health inequalities and sensitive populations in London

3.5 Reducing inequalities in health, whereby one group of people experience poorer health and a lower quality of life than the rest of society, is an important focus for social policy. To this end the Mayor has produced the *London Health Inequalities Strategy* (3). Climate change will exacerbate existing inequalities in health (2) so measures to increase resilience amongst London's population are consistent with this strategy.

What are the main characteristics of London's population?

3.6 An important step in any population risk assessment is to identify the characteristics, and the sensitivities, of the population. Each of these factors will be affected by changes in the climate as the city positions itself within a national, European and global economy that adapts to and accommodates climate change. The nature of London's population and of the many factors that influence health emphasises the importance of working in partnership to identify how systems and services will be adapted to cope with a changing climate.

3.7 Demographic profile: London is a young city: in 2007 31% of the population was under the age of twenty four; 15-44 years olds account for 49.5% of the population compared to England average of 41.6%; and the proportion of people of retirement age is the lowest of all regions (13.8 %).

3.8 Between 2011 and 2031 London's population is projected to increase by 1.02 million persons, equivalent to 13 per cent. Households are expected to increase by 667 thousand, or 20 per cent. The difference in the rates of change is a reflection of the 6 per cent decline in average household size from 2.32 to 2.18. The structure of household change is dominated by the 455 thousand increase in one-person households that accounts for 68 per cent of the total household growth between 2011 and 2031. Married couples are the only household type projected to decline, with the loss being more than compensated by the increase in cohabiting couples (29).

3.9 Between 2011 and 2031 the growth in population is seen at nearly all age groups. The major exception is the under-5s, which reflects the downward revision in national fertility assumptions. The changes demonstrate both a distinct ageing pattern, particularly with an increase of over 400,000 persons between ages 45 and 64 as well as a significant increase in the child population, with 115,000 more children of school age (ages 4-15). The elderly population is projected to grow particularly fast. The over 65s are projected to increase by 34 per cent, or nearly 300,000, to reach 1.17 million by 2031. The over 90s are expected to almost double to 96,000. Between 2011 and 2031 there is a 500,000 increase in the resident labour force aged 16-74, equivalent to 12 per cent. The female contribution to the labour force rises by 280,000 and is 56 per cent of the total growth. (29).

3.10 Here we supplement a snapshot of London's population which is provided in the *London Health Inequalities Strategy* (3) with some key facts from the London Health Observatory and NHS London (30).

- **Size:** London is home to more than seven and a half million people. Because of London's high birth rate, the population is projected to continue to rise for the next 20 years.
- **Economic activity:** Up to one million people commute into the capital to work or visit each day.
- **Population mobility:** The population is also highly mobile. In 2006/07, 167,000 people moved into London and 248,000 moved out of the city. Wealthier people tend to move out of the capital at retirement age.
- **Ethnicity:** London is one of the most ethnically diverse cities in the world. People from Black, Asian and other minority ethnic (BAME) groups made up 33% of London's population in 2006. This is projected to increase to 39% by 2026. The BAME populations are relatively young. They are however growing above the national average and ageing although there are large variations in the demographic structure of different ethnic groups.

- **Inequalities:** Londoners are among the richest and the poorest people in the UK. The London borough of Hackney is both one of the ten poorest local authorities in the country and in the top ten for the number of high earning residents. This pattern, of a significant gap between rich and poor, is found right across the city but is most pronounced in inner London. Within London there are wide inequalities in living conditions, and other socio-economic factors that have an influence on health. These inequalities exist between people living in different parts of London, between different ethnic groups, age groups and other groups.
- **Lifestyle issues:** Obesity, smoking and alcohol are contributing to poor health in London's more deprived areas: the prevalence of children aged 10-11 at risk of obesity was 80% higher for those living in the most deprived areas of London, compared with those in the least deprived areas.
- **Health services:** Primary care services are performing relatively poorly. London has significantly higher than average demand for mental health services, particularly for people with severe mental illness. Londoners are more dissatisfied with the NHS, especially those from BAME groups.

3.11 People currently move to London seeking opportunity, both from positions of strength and from positions of weakness. This will continue as migration is one response to climate change. There are many uncertainties in attempting to forecast future population movements that may be exacerbated by climate change. It is clear that there is considerable scope for careful and coordinated policies to minimise many of the potential costs and maximise many of the potential benefits arising from migration (31).

3.12 Direct cause-and-effect relationships between climate change and migration are difficult to establish. The factors motivating any decision to migrate are complex and difficult to forecast. DECC and the Home Office are therefore sponsoring a project by Foresight, in the Government Office for Science, to look at global migration due to environmental change. This will provide the Government with a better understanding of the long-term impacts on migration, and the challenges and opportunities it could bring and how these might be addressed (14).

3.13 Information is important: population movements must be monitored so that increases can be detected and responded to in a measured way. The historical information on London's population must be continually supplemented with current surveillance information and future forecasts.

3.14 Profiling, mapping and other components of risk assessments will need to be carried out at appropriate levels *e.g.* street, neighbourhood, local authority, London-wide etc or by specific population group. This will assist with Joint Strategic Needs Assessments (JSNAs) and other similar exercises.

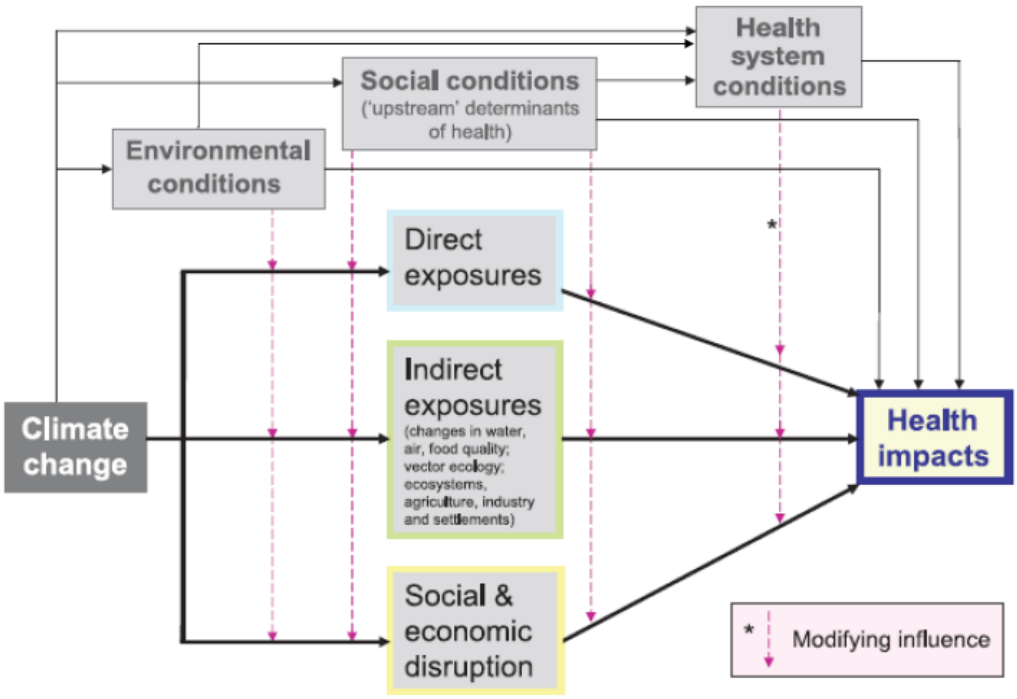
Health and a changing climate

3.15 Figure 2 shows the pathways by which climate change affects human health. It shows us climate change will affect:

- environmental conditions which will affect health for example through heatwaves or flooding;
- social conditions, for example the conditions in which people access employment, education, leisure etc, and the means by which they access them; and
- the health system itself for example through a need to deal with different diseases and/or a change in the prevalence of particular conditions, or the ability to deal with extreme events.

3.16 Figure 2 also shows us that each of these pathways is inter-related: social conditions will affect health systems. We have ourselves added an arrow to indicate that environmental conditions will also affect health systems. Each of these will be experienced directly, indirectly and as a result of disruption.

Figure 2: Schematic diagram of pathways by which climate change affects health, and concurrent direct-acting and modifying (conditioning) influences of environmental, social and health-system factors



Adapted from Confalonieri et al (24)

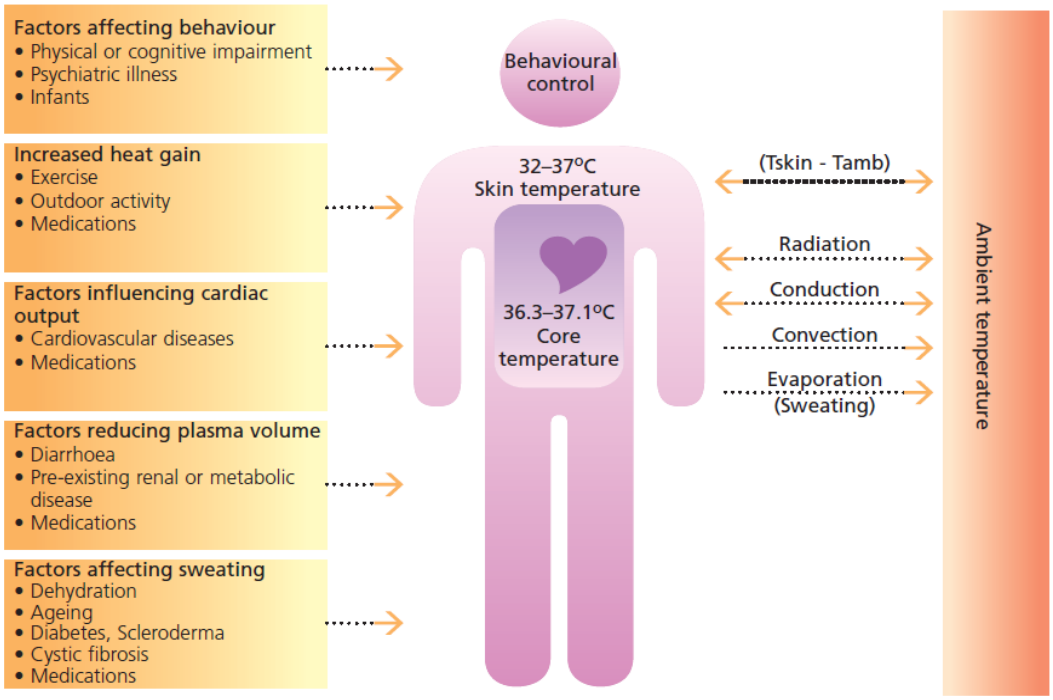
3.17 Climate change will affect health through extreme events such as floods or heatwaves and through the gradual change in average conditions. Table 1 from the CCAS (1) shows the principal effects of weather on health outcomes.

Table 1: Principal effects of weather on health outcomes

Health outcome	Known effects of weather/climate
Heat stress, cold stress	Deaths from heart- and lung-related diseases increase with hotter and colder temperatures. Heat-related illnesses (heat cramps, heat exhaustion and heat stroke) and death increase during heatwaves.
Air pollution related morbidity and mortality	Weather affects air pollution concentrations. Weather affects the distribution, seasonality and production of air-transported allergens.
Morbidity and mortality resulting from weather disasters	Floods and windstorms cause direct effects (deaths and injuries), infectious diseases, long-term mental health problems, and indirect effects (temporary limitations on access to health and social care services).
Vector-borne diseases	Higher temperatures shorten the development time of pathogens in vectors and increase the potential transmission to humans.
Water- and food-borne diseases	Survival of important bacterial pathogens is related to temperature. Increases in drought conditions may affect water availability and water quality (chemical and microbiological load) due to extreme low flows. Extreme rainfall can affect transport of disease organisms into water supply.
Cataracts, skin cancers and sunburn	More cloud-free days and higher temperatures may encourage potential risk of over-exposure to UV radiation.

From GLA (1)

Figure 3: Factors affecting human thermoregulation and the risk of heat illness



Cited in WHO (32)

Heatwaves

3.18 Figure 3 above shows factors affecting human thermoregulation and the risk of heat illness. With regard to heatwaves, death is more likely to occur in the elderly or chronic sick (25). High temperature episodes are often associated with high pollution episodes. In addition to the broad categories of causes of death, many diseases are exacerbated by heat, for example endocrine disorders (e.g. diabetes), skin disease and infections. In general heatwaves affect (33):

- older people, especially those over 75 years old and living on their own, or in a care home;
- people suffering from mental ill health, those with dementia, and those who rely on help from other people to manage day-to-day activities;
- people who are bed-bound or have mobility problems;
- people taking certain types of medication;
- people with a serious chronic condition, particularly breathing or heart problems;
- people who already have a high temperature from an infection;
- people who use alcohol or illicit drugs;
- babies and young children, especially under four years old;
- people who are physically active such as manual workers, or sportsmen and women.

3.19 Specific groups of Londoners with particularly high rates of mental health problems include refugees and asylum seekers, homeless people, and those who misuse alcohol and drugs (3).

Flooding

3.20 Flooding carries a range of potential immediate, intermediate and long-term direct and indirect health risks, wherever a flood occurs (25).

3.21 Table 2 shows that flooding can have an immediate impact *e.g.* physical injury and death, often to younger men, and longer-term effects *e.g.* mental health concerns associated with loss of possessions and difficulty of insuring properties that have been subject to flood. The after-effects of the floods in Banbury, Oxford, were particularly hard for Asian women who typically spend a greater amount of time in the home and whose homes had been damaged (34). Men and women cope with the after-effects of floods in different ways (35).

3.22 Stanwell-Smith states that the health effects of water disasters are usually due to the lack of prompt restoration of public health services and interventions, with the resulting risk of epidemics and other ill health (25). Studies in the UK and USA suggest that infection problems are rare: the indirect nature of the risk means that they are also extremely difficult to quantify or attribute to the flood.

Table 2: Summary of potential health risks from floods

Immediate: during pre-onset and onset phase	Drowning
	Injuries from debris; and from damage to property (eg exposed wiring)
	Heart attack
	Exposure to chemicals/ toxic gases
	Exposure to pathogens
	Impaired capacity of health care systems
	Damage to property
	Infections due to overcrowding/poor facilities/reduced ability to maintain good hygiene
Intermediate	Mental ill health
	Exposure to pathogens
	Malnutrition
	Dehydration
Long-term	Mental ill health
	Physical ill health

Adapted from Stanwell-Smith (25)

3.23 Taken together, these findings regarding direct health impacts have implications for the different ways in which contingency plans are prepared and for the ways in which support and advice need to be offered.

Indirect health impacts

3.24 Additional to the direct impacts on health that are outlined above, there are a number of potential indirect impacts of climate on health. These are less easy to decipher from climate change projections, but are of potentially greater consequence for health over the long term. They include many of the wider determinants of health (as identified in Figure 1). We have mapped some indicative climate change adaptation responses against these determinants as Figure 4 below. For the purposes of this report we concentrate upon *living and working conditions*.

Implications for Action

- Health is determined by an interplay of individual lifestyle, social, economic, cultural and environmental factors.
- Effective adaptation will be based on an understanding of how individuals and populations respond differently to weather and climate.
- This spans contingency planning and the ways in which information, advice and support are made available.
- New health needs will emerge and existing health needs will be exacerbated by climate change.
- It is necessary to enhance knowledge of the relevant needs of vulnerable and so-called hard to reach groups and to target measures accordingly.
- Given the range of determining factors and the complex and dynamic profile of London's population, partnership and multi-agency responses will be required.
- In particular, the sharing of data, analysis and experience between health, social care and environmental stakeholders.

Figure 4: Climate change adaptation and determinants of health

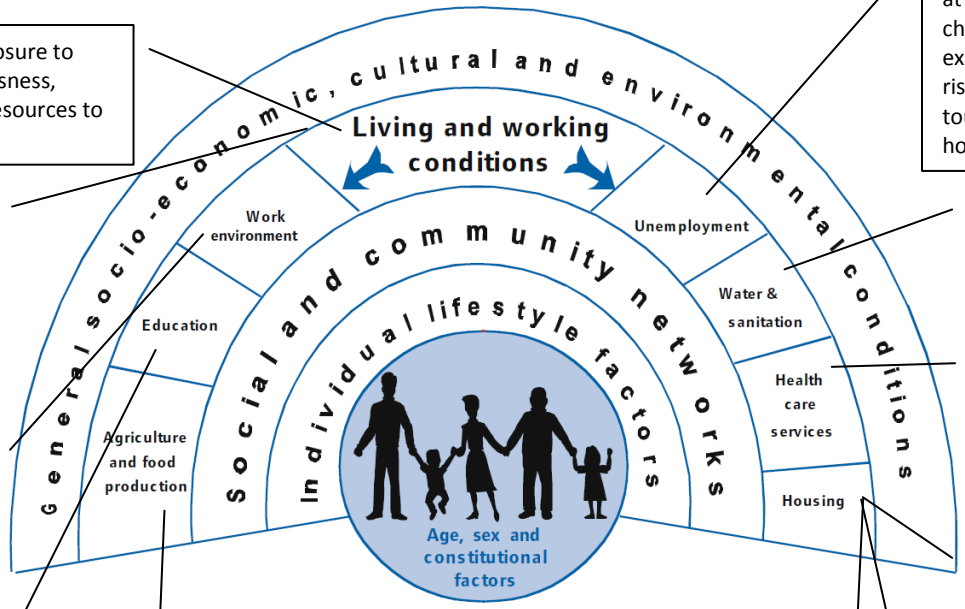
Disadvantaged groups will suffer greater exposure to extreme weather risks, flooding and homelessness, whilst lacking insurance and other material resources to cope with the effects of climate change (2).

Need to understand the relationship between the residential locations of Londoners and their access to health service points during any given weather event. This should be cross-referenced against data to indicate health and social care needs.

Workplace productivity can be reduced by a range of climate impacts, from difficulties in accessing the workplace to excessive temperatures causing tiredness and fatigue.

Weather and climate affect levels of concentration, particularly amongst school children, with hot weather increasing tendency towards aggressive behaviour.

London is almost entirely reliant on areas beyond its boundaries for food. Produce often comes from distant locations, equally, or more at risk from climate change, extreme weather events or 'cascade climate impacts'. Resilience could be developed through improved supply chain management. Initiatives to grow food on the healthcare estate can deliver wider health benefits and provides good example to other landowners.



Wetter winters will cause some sections of the housing stock to be more prone to deterioration, such as from penetrating damp. Lower income groups in owner-occupied or rented accommodation are less likely to address these impacts, leading to a potential exacerbation in health inequalities associated with, in this example, poor housing.

The connection between economic wellbeing at a sub-regional scale and different climate change scenarios warrants study. For example, the GLA CCAS (1) suggests that rising temperatures may benefit London's tourist industry. Inclement weather may, however, restrict travel to London.

Higher summer temperatures, reduced flow in rivers and drought conditions can be associated with poor water quality (sanitation and food safety).

This report identifies a range of potential negative impacts of climate change on health care locations and on the provision of health and social care services.

Choice of household location will often be premised on affordability. Relocation to less at-risk areas in response to climate change is equally restricted.

The highest housing densities in London are associated with both the highest and lowest income deciles. Higher housing densities are often associated with greater susceptibility to excess heat and proneness to vector borne diseases from rodents, mosquitoes and other disease bearing insects (which also has implications for resources allocated to waste collection and management during hot weather).

4. Which organisations deliver health and social care in London?

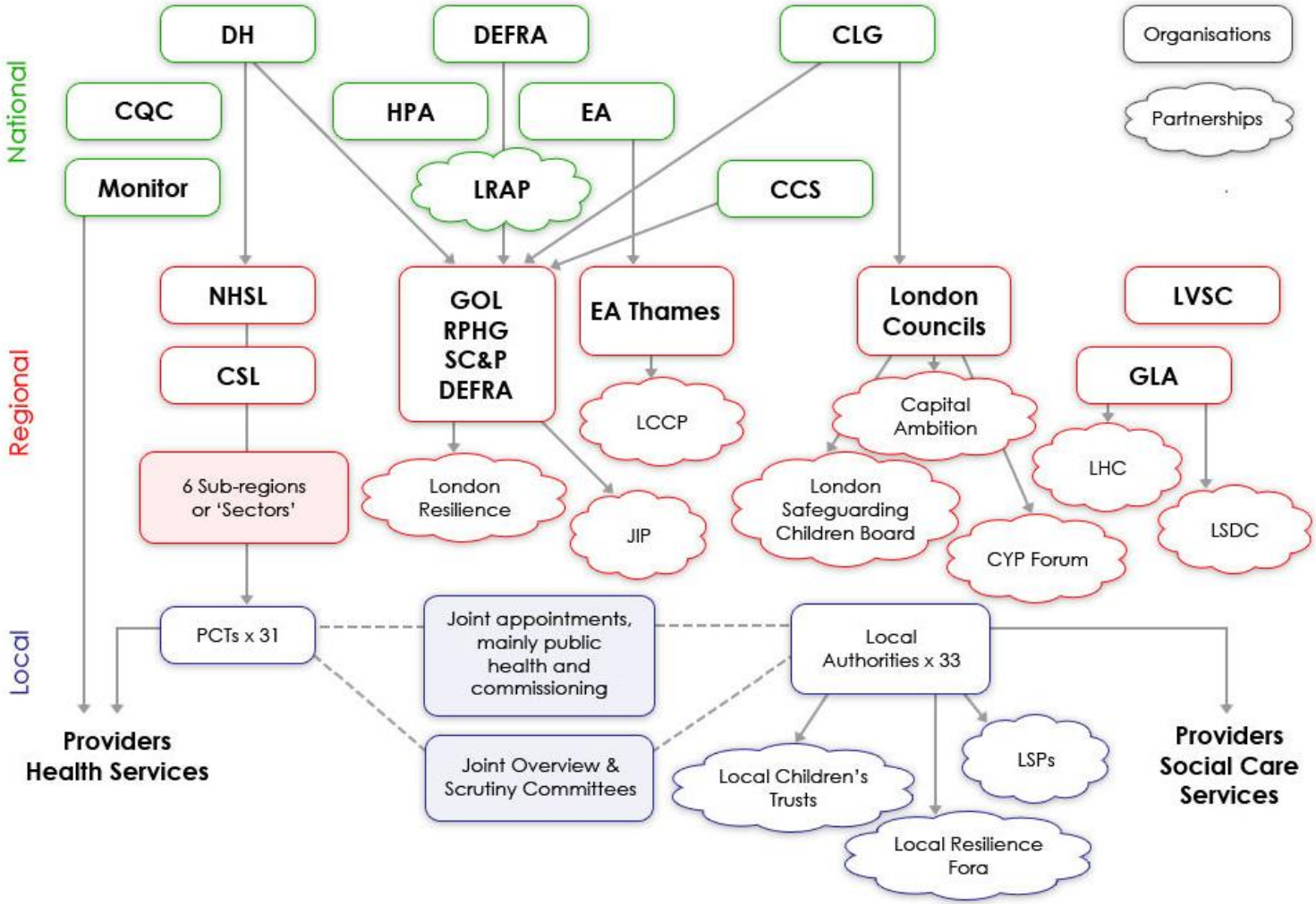
4.1 The organogram below, along with Table 3 which follows, plots the key national, regional and local organisations and partnerships with explicit, implicit or potential responsibilities for climate adaptation in relation to health.

4.2 This written report is supported by a bespoke online application *Climate Risk Mapper* which gives instant access to data helping to visualise the locations of health and social care provision in the context of projected climate change risks. *Climate Risk Mapper* includes an interactive display of this material.

4.3 To access the application, please visit http://beta.geofuturesonline.com/GLA and enter the login details you have been given (if necessary, contact the authors).

4.4 For detailed instructions, see Appendix 2.

Figure 5: Organogram: Core functions in London's health and social care provision



Multi-stakeholder partnerships are here linked to their host organisations. For full membership visit the relevant websites.

Table 3: Supporting adaptation in health and social care: national, regional and local functions

Organisation or partnership	Core purpose	Climate adaptation role
National		
Department of Health	Government department responsible for health improvement and wellbeing of people in England. Sets policy, standards and priorities for the NHS and defines policy and guidance for social care.	Departmental Climate Change Plan 2010 builds climate mitigation and adaptation into policies and strategies across departmental responsibilities. Sustainable Development Action Plan 2009-11 commits specifically to improve sustainability of social care and of procurement/supply chain via adaptation.
Health Protection Agency	Independent organisation set up by government to protect the public from threats to their health from infectious diseases and environmental hazards.	Evidence and guidance for health sector including *Health Effects of Climate Change in the UK* (last updated 2008)
Care Quality Commission	Independent regulator of health and social care in England, regulating care provided by the NHS, local authorities, private companies and voluntary organisations. Includes care in hospitals, care homes and people's own homes.	Climate Adaptation Role: Potential to build climate change adaptation into national minimum standards, for example in residential care.
Monitor	Independent regulator of NHS Foundation Trusts (FTs), directly answerable to Parliament. FTs are not-for-profit, public benefit corporations. They are part of the NHS and currently provide over half of all NHS hospital and mental health services.	Regulatory role complemented by developmental support. Require Foundation Trusts to report on sustainability and climate change.
Communities and Local Government	Government department which sets policy on local government, housing, urban regeneration, planning and fire and rescue.	Departmental Adaptation Plan 2010: builds adaptation into policies and strategies across departmental responsibilities. As the Department responsible for local government, leads the development and oversight of Local Area Agreements, National Indicators etc. As at April 2010, consulting on Planning Policy Statement: Planning for a Low Carbon Future in a Changing Climate, which contains a number of policies on adaptation.
Dept for Environment, Food and Rural Affairs	Government department responsible for policy and regulations on the environment, food and rural affairs, including climate change adaptation across government.	Adaptation Across Government, including co-ordination and oversight of Departmental Adaptation Plans
Environment Agency	Government agency answerable to DEFRA whose principal aims are to protect and improve the environment, and to promote sustainable development.	Particular role providing information and guidance in relation to rivers and flooding in addition to regulatory functions.
Local and Regional Adaptation Partnership Board	Facilitates action on climate change adaptation at a local and regional level.	LRAP board established 2008 with time-limited role (to 2011) to facilitate regional and local action such as best practice sharing

Organisation or partnership	Core purpose	Climate adaptation role
Civil Contingencies Secretariat	Sits within the Cabinet Office and works in partnership with government departments, the devolved administrations and key stakeholders to enhance the UK's ability to prepare for, respond to and recover from emergencies.	Emergency preparedness function in relation to extreme weather events
London regional		
Government Office for London	Represents 12 government departments, acting as interface between national, regional and local government. Through co-ordination and partnership, helps make sure local services are delivered effectively for Londoners. . Negotiates and monitors Local Area Agreements, including National Indicator 188 'Planning to Adapt to Climate Change'.	Combines scrutiny and developmental functions with particular emphasis on integrated working across Departments. Assessment of Local Community Strategies and Local Area Agreements presents opportunity to enhance adaptation capacity of health and social care stakeholders, working with regional colleagues. Specifically, delivers National Indicator 188 workshops and provides one-to-one support to drive up performance at local authority level. Acts on behalf of Secretary of State on land use planning matters in London and hosts the London Resilience Team.
Regional Public Health Group	Represents DH at GOL. Wide range of public health responsibilities improving and protecting health and tackling inequalities.	As above, and with additional focus on underpinning Joint Strategic Needs Assessments (JSNAs) and Commissioning Strategy Plans of Primary Care Trusts. Opportunity to enhance adaptation capacity of health and social care stakeholders. Likely role supporting implementation of new DH Climate Change Plan, and potential to support local development/exemplar activity.
Social Care and Partnerships (London)	Represents DH at GOL. Supports local authority and key partners to implement national policy and develop regional performance and efficiency in social care.	As above.
NHS London	Strategic Health Authority with responsibility to ensure that national priorities are met within resources. Performance manages Primary Care Trusts (PCTs) and non Foundation Trust NHS Trusts. Through the office of the Regional Director of Public Health also advises the Mayor of London on health matters.	Translates national policies and strategies to achieve optimum health outcomes for Londoners. Scope to develop London-specific targets and build adaptation requirements into assurance of local and sub-regional/sector commissioning plans in order to deliver Healthcare for London. Scrutinise and assure local capital developments, with potential to strengthen adaptation requirements.
Commissioning Support for London	Funded by the 31 London Primary Care Trusts to provide 'business to business' products and services including health needs analysis, and commissioning guidelines.	Scope for increased provision of data at regional and local level regarding health effects of climate change (London Health Observatory). Ongoing development of guidance and best practice in new care pathways could take account of climate change impacts.
London Councils	Think-tank and lobbying organisation promoting the interests of London's 33 Councils. Runs a number of pan-London services and hosts partnerships such as Capital Ambition. Governed by local authority elected members.	Further scope for integration of best practice regarding climate adaptation in joint programmes including Improvement and Efficiency agenda. Leadership role as governed by elected members.

Organisation or partnership	Core purpose	Climate adaptation role
Greater London Authority	Strategic authority with a London-wide role "to design a better future for the capital". Supports the Mayor of London by helping to develop and deliver strategies for London. Supports the London Assembly in its role of scrutinising the work of the Mayor and representing the interests of Londoners. Oversees the Functional Bodies of Transport for London, London Development Agency, London Fire and Emergency Planning Authority and Metropolitan Police Authority.	Distinctive local authority with cross-cutting duties and powers with regard to health, health inequalities, sustainable development and climate change. Complementary Mayoral Climate Adaptation and Health Inequalities Strategies due to be published in 2010.
Environment Agency (Thames Region)	Regional office of national agency. Hosts London Climate Change Partnership (LCCP).	Regional environmental expertise. Now hosting LCCP (as of March 2010).
London regional partnerships and non-statutory organisations		
London Health Commission	A non-statutory cross-sector partnership working with agencies across the capital to reduce health inequalities and improve the health and well being of all Londoners. Chair appointed by the Mayor of London.	Focus on wider determinants of health and known for particular expertise in developing best practice in health and integrated impact assessment, with potential to strengthen climate adaptation criteria. Role overseeing health impact assessments of Mayoral and other regional strategies. As an independent voice, in a position to challenge statutory agencies
London Sustainable Development Commission	Established to advise the Mayor of London on making London an exemplary sustainable world city. Made up of individual experts from the economic, social, environmental and London governance sectors.	Complements London Health Commission with similarly holistic outlook and commitment to promoting health and equality including in relation to environment. Collaborates with LHC including for health and integrated impact assessments and other scrutiny roles at regional level. As an independent voice, in a position to challenge statutory agencies.
London Resilience	Partnership between the Government, the Mayor of London and all the capital's key responding agencies and organisations to prepare London for the consequences of a major emergency.	Particular focus on emergency preparedness including health and environmental emergencies. Potential to enhance practice by taking into account incremental climate change and likely increase in incidence of extreme weather events.
The Children and Young People Forum	Consists of 33 Councillors who work together to provide a focus on children and young people's issues at member-level. Aim is to enable London Councils to assist boroughs in the implementation of the Children Act 2004.	Leadership role through elected membership, with potential to set the agenda in promoting climate adaptation in resilience across children's services, including education.
The London Safeguarding Children Board	Provides strategic advice and support to London's 32 Local Safeguarding Children Boards (LSCBs). A joint initiative by London Councils, NHS London, Metropolitan Police Service, London Directors of Children's Services, Chairs of London LSCBs, and London Probation Service.	Potential to extend understanding of and practice in relation to "safeguarding" in a climate change context and highlight responsibility to adapt children's services and build resilience such as through the Every Child Matters Framework.

Organisation or partnership	Core purpose	Climate adaptation role
London Climate Change Partnership	A cross-sector stakeholder group co-ordinated by the Environment Agency (Thames Region). Develops and disseminates information and research and encourages organisations to work together and embed adaptation to climate change in their decision-making.	The lead regional partnership for climate adaptation committed to supporting best practice in health and social care in conjunction with sector colleagues.
Capital Ambition	London's Regional Improvement and Efficiency Partnership (RIEP), which supports local authorities and their partners to identify and deliver significant efficiencies, major improvements in services, and explore innovative ways of working to transform local government delivery.	Best placed to promote adaptation to social care stakeholders with clear focus on local government priorities especially the improvement and efficiency agenda and related initiatives such as Total Place.
Joint Improvement Partnership	Boroughs work through the JIP to shape the vision and strategy for meeting the challenges of delivery of social care across London. Provides the basis for the main agencies involved in Adult Social Care & Health Improvement & Efficiency to work together.	Dovetails with the cross-sectoral role of Capital Ambition to drive improvement and innovation in adult social care specifically. Potential to drive and develop best practice with regard to adaptation, integrating lessons from the national Sustainable Social Care Programme and other commitments in the DH Climate Change Plan.
London Voluntary Service Council	Represents, champions and enhances London's diverse voluntary and community sector.	Promotes the sustainability and resilience of the voluntary and community sector, whether as providers of health and social care services or in broader role underpinning sustainable and cohesive communities. Potential role for London progressing commitments in *Shaping Our Future* (36), the report of the joint Ministerial and Third Sector Taskforce on climate change, the environment and sustainable development.
Local organisations		
Primary Care Trusts	Secure provision of services to meet local needs and national and local priorities; commission and manage provider contracts. 31 co-terminous 1:1 with boroughs except City & Hackney and Merton & Sutton. Work in 6 sectors or sub-regions, especially to commission acute services. Public health and primary care remains largely local. Further and more formal integration across boundaries is anticipated.	Assess needs, design and commission local health services and facilities, in conjunction with local authority and other (especially LSP) partners. Scope to use local leadership role and commissioning leverage to set environmental standards and support improved practice in climate adaptation. Must adhere to BREEAM standards and DH guidance with regard to capital developments. Scope to enhance adaptation dimension to JSNAs.
Local Authorities	32 London boroughs plus the Corporation of London. Provide and commission a wide range of services including social care, education and environment.	Statutory responsibilities with regard to Local Strategic Partnerships, community strategies and Local Area Agreements point to leadership role ensuring adaptation addressed as a cross-cutting theme. All local authorities are required to report on progress against National Indicator 188 Planning to Adapt to Climate Change.

Organisation or partnership	Core purpose	Climate adaptation role
Overview and Scrutiny Committees	Local Authorities with social services responsibilities have the power to scrutinise local health services. OSCs take on the role of scrutiny of the NHS including ongoing operation and planning of services. In practice, the bulk of scrutiny business takes place outside of committees in more informal settings, often with a wider purview of health and wellbeing.	Potential role raising expectations with regard to adaptation across health services, strengthened by democratic accountability.
Health provider organisations	NHS and independent providers: GPs, dentists, opticians, pharmacists, walk-in centres and community services; Acute Hospital NHS Trusts; Mental Health NHS Trusts; London Ambulance Trust; Independent Sector providers (private and Third sector); NHS Foundation Trusts.	Facilities and services for people with health needs should be made as resilient as possible to climate change. Emergency and acute service planning should take account of climate change, particularly increased incidence of extreme weather events. Potential for frontline staff to help raise awareness at community level.
Social care provider organisations	Statutory and independent providers of residential, domiciliary and other services to help people overcome difficulties related to physical, mental, environmental or lifestyle problems at any stage in their lives.	Facilities and services for people with social care needs should be made as resilient as possible to climate change. Potential for frontline staff to help raise awareness at community level.
Local partnerships		
Local Strategic Partnerships	Borough-level cross-sector partnerships charged with developing and driving Community Strategies and Local Area Agreements.	Climate change adaptation considerations applicable across local needs and priorities and best addressed in cross-cutting strategies for which LSPs responsible.
Children's Trusts	Bring together all services for children and young people in an area, underpinned by the Children Act 2004 duty to cooperate, to focus on improving outcomes for all children and young people. Span health, care and education.	Holistic responsibilities, particularly but not only with regard to vulnerable children, point to a role ensuring awareness of and adherence to good practice with regard to adaptation.
Local Resilience Fora	Chaired by local authority chief executives. Identify and assess local risks that could cause an emergency including flooding, pandemic flu and utility failures.	Community basis and responsibilities across health and environment place in strong position to develop best practice adapting to climate change.

5. How will changes in London's climate affect services and people?

5.1 In this chapter, we turn our attention to London's climate and to the impacts of a changing climate on health and social care service provision in the capital as well as those who currently or potentially use those services.

5.2 Observed and predicted changes to London's climate pose risks and opportunities for the provision of, and the demand for, health and social care services. They do so directly, such as a flood preventing access to a hospital, and indirectly, such as by creating economic stresses and pressures which in turn affect human health and the resourcing of services.

5.3 Many direct climate risks for London are identified and documented and they have largely predictable implications for the provision of health care through their impact on the locations where services are provided. Social care is not so easily identified in this way because services are delivered in diverse and dispersed locations by a plethora of providers and in many cases (and increasingly) at home. Proxy data, such as demographic or socio-economic data, will, therefore, need to be used to infer the spatial distribution of social care services and hence their vulnerability to extreme weather events and climate change. In the absence of these data, there may be a bias towards making decisions, such as for service reconfiguration, that affect only known health service locations.

5.4 Similarly, some climate changes are either less predictable, or will occur with more subtlety. Again, there is a risk that their health impact is not fully anticipated, meaning that collection and sharing of data to enable more sophisticated mapping of risk should become a high priority.

Anticipating climate and weather impacts

5.5 In order to help to guide planning for short and longer term anticipated climate risks, we have created Table 4 which captures in broad terms the geographic predictability of each and suggests some practical adaptation options.

5.6 Gradual and subtle changes tend to be harder to map. This means that additional sources need to be considered, for example, to give an indication of the fitness of housing in different areas to cope with a range of projected climate conditions.

5.7 It is also worth noting that the health consequences of longer term climate change, as opposed to extreme 'weather events' are largely secondary, i.e. wetter winters may affect conditions in the home which in turn affect health.

5.8 Table 5 therefore looks at the implications for health and social care provision of both the general anticipated climate change trends and the high impact weather events, the probability of which are assumed to be increasing.

Table 4: Anticipated climate change: health service impacts (provision and demand)

Anticipated change	Implications for service provision	Geographic predictability	Implications for service demand	Adaptation options
Sea level rise	Flood risks spread to new areas. Sea level rise is not currently included in Environment Agency flood risk assessments.	Medium	More homes at risk from tidal flooding. Proxy data could be used to establish whether there is a bias towards more vulnerable households	Key service relocation and emergency route assessments
Increased storminess	Possible implications for building design (stress to buildings and infrastructure) and staff access to the workplace	Low	Probability of physical injury increases	Public information Risk assessments of buildings
Seasonally increased precipitation	Greater risk of localised surface water and sewer flooding	Low	Potential for greater prevalence of breathing-related conditions	Sustainable Urban Drainage (SUDS)
Hotter, drier summers	Greater risk of power outages Great risk of water shortages	Low	Increase in prevalence of various sun and heat related health conditions	Rainwater harvesting. Greywater recycling On-site renewable (particularly solar) Public information
Accentuated wet/dry cycles	Potential implications for building structures, particularly subsidence	Low	Potential for greater prevalence of breathing-related conditions where people's homes are affected. Also, contaminated land be subject to an increasing risk of exposure of contaminated materials at the ground surface (37)	SUDS Rainwater harvesting/ greywater recycling
Warmer winters	Recent studies have indicated that warmer winters likely to be associated with an increase in precipitation, which counterintuitively, may be more likely to fall as snow (38).	Low	Service demand reduction for cold-related conditions associated with reduction in fuel poverty	Care closer to home may benefit staff access to the workplace

Table 5: Individual event: health service impacts (provision and demand)

Climate Impact	Implications for service provision	Geographic predictability	Implications for service demand	Adaptation options
Flood (fluvial)	Healthcare buildings physically damaged/ isolated	High	Emergency services diverted, emergency plans triggered	Relocation/ defence
	Dwellings physically damaged/ isolated		Physical injury Stress/ mental health	Care closer to home Community flood planning
	Access to healthcare buildings restricted for staff and contractors		Increased pressure on neighbouring facilities	Increased total capacity and greater distribution of expertise
	Failure or damage to key building services, such as heating, cooling or drinking water supply		Increased pressure on neighbouring facilities	Greater resilience designed into key buildings and services
	Contamination of drinking water		Problem likely to be common to local population	Relocation/ defence of water pumping facilities Backup bottled water
	Supply-chain interuptions	Medium	Increased pressure on neighbouring facilities	Greater resilience designed into the supply chain, including climate change-specific lifecycle assessment.
Flood (tidal)	As for fluvial flooding	High		
Flood (surface water)	Contamination of drinking water	Medium	As above	Backup bottled water
	Access restrictions/ damage to buildings		Travel disruption/ physical health risks	More alternative facilities in less at-risk locations Community flood planning
Flood (sewer)	Contamination of drinking water through sewage backing up in buildings	Medium	As above and likely to be associated with surface water flooding	Backup bottled water
Drought	Increased potential for power outages – reducing energy availability for demands which may currently be considered non-essential, including cooling and ICT	Medium	Demand spike for heat-related emergencies If power outages occur - potential difficulty in securing repeat prescriptions, medical records etc.	On site generation/ decentralised energy

Climate Impact	Implications for service provision	Geographic predictability	Implications for service demand	Adaptation options
	Assuming drought is associated with high temperatures, there is the potential for failure of some road and rail infrastrucure (such as embankment collapse), restricting access		Access to health facilities more challenging	Care closer to home Greater water efficiency
	Abstraction limits for water imposed		Vulnerable individuals likely to suffer the most from lack of access to water	Rainwater harvesting Drinking water storage solutions
	Water storage shortages due to pre-existing concerns about legionella		Emergency services may need to be diverted	Drinking water storage solutions
Heatwave	Increased potential for power outages	Low	Demand spike for heat-related emergencies	On site generation/ decentralised energy
	Productivity/ staff shortages problems		Service restricted to priorities only	Workplace design Emergency staffing plans
	Indoor mechanical ventilation has capacity to spread infectious disease		Services may be diverted to alternative locations	Awareness and prevention Maintenance/update of ventilation systems
	Increased risk of poor water sanitation and food contamination		Risk of poor water sanitation and food contamination increasing demand	Reduce risk of poor water sanitation or food contamination through building design and procedural changes. Building technology solutions such as use of air source heat pumps on reverse cycle
	Potential loss of front line staff to illness		Increased prevalence of vector-borne diseases unfamiliar to medical staff	Research and information on probable diseases at each UKCIP average temperature scenario
Windstorms	Buildings physically damaged Loss of utilities	Low	Dust-related health problems Risk of physical injury	Care closer to home

Areas of risk for health and social care provision

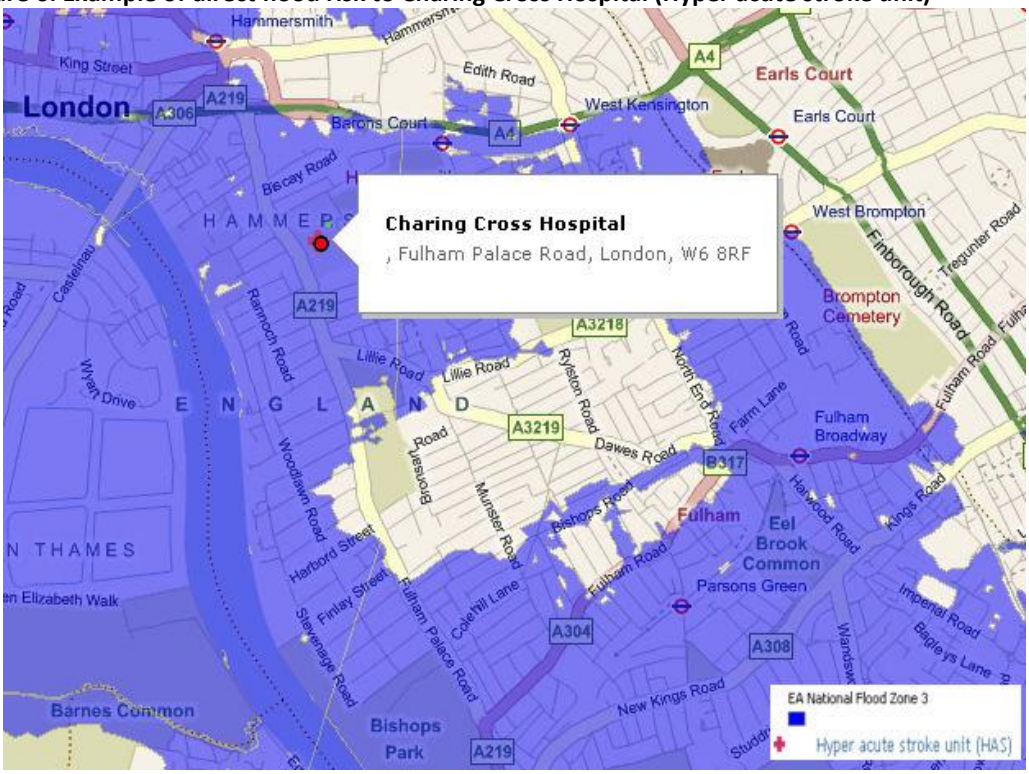
Location of services

5.9 The physical locations where health and social care services are delivered (service points) are at varying risk of being directly affected by a significant weather event. Some could potentially be rendered temporarily or permanently useless. Whilst the distribution of some climate risks may be less predictable (vulnerability to strong wind for example), the distribution of others, such as tidal or surface water flooding, can be mapped relatively accurately with a range of probabilities used to predict extent or severity. The provision of flood defences for individual acute sites has been historically considered to be excessively costly, a situation which could conceivably change subject to future climate change projections. Whilst urban density and form play a major role in the prevalence of urban heat islands, facilities need to be close to major centres of population and therefore best practice in heat island mitigation will play a vital role in combating excessive heat, including biomimicry, urban greening (including living roofs) and the provision of new green space, including accessible and safe water features and drinking water fountains.

5.10 The location of service points, however, is no straightforward matter. Whilst the current location of key services, such as hospitals or health centres is known, their future locations could, and in some cases should, change. Healthcare for London has already led to some service reconfiguration and further changes are at various stages of planning. It appears that climate change mitigation and tackling carbon emissions have been taken into account, at least to some extent; but not, however, climate change adaptation requirements. For example, the climate related risks associated with the recent concentration of hyper acute stroke units into fewer locations (implemented for sound clinical reasons). See Figure 6 below which demonstrates the direct flood risk to Charing Cross Hospital in West London, location of one of the designated hyper acute stroke units following reconfiguration.

5.11 For social care, the point of service delivery will often fall within the homes of service users, and therefore the location – and, therefore, the climate related risk - naturally shifts and fluctuates and can be mapped only to the extent that these data are known and current.

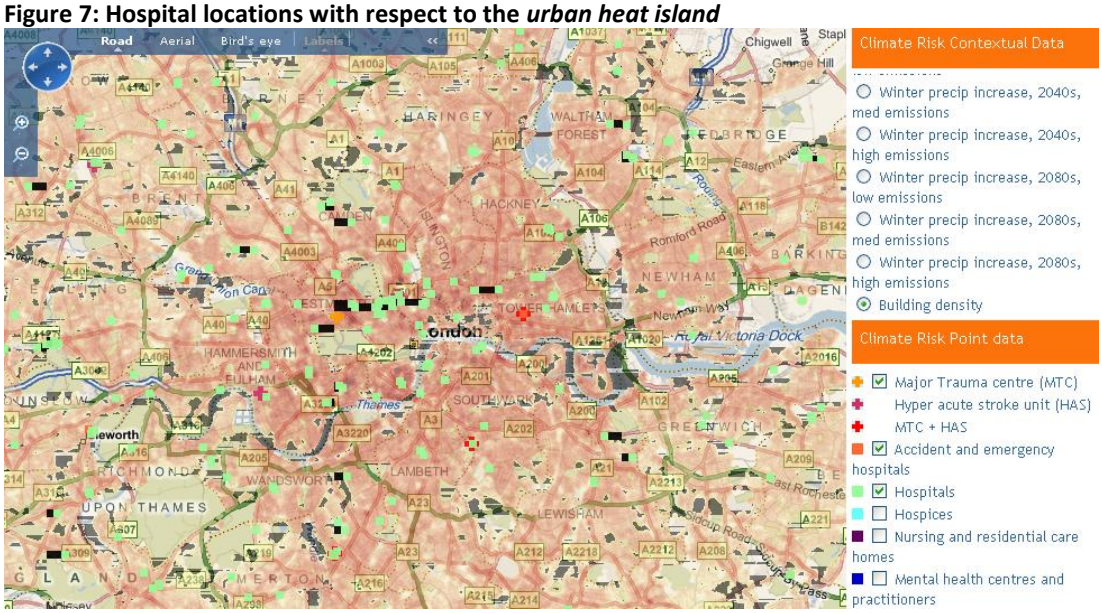
Figure 6: Example of direct flood risk to Charing Cross Hospital (Hyper acute stroke unit)



n.b. Risk of tidal flooding depicted in Figure 6, Figure 8 and Figure 9 is at 1:200 (Environment Agency)

5.12 It is also possible to map the heat related risks to hospital facilities across London. The excerpt below from the *Climate Risk Mapper* associated with this report (see Appendix 2) uses building density as the best available proxy for the urban heat island effect (the higher temperatures found over and around more dense urban areas). In this example, the distribution of hospitals correlates positively with the distribution of heat, giving rise to the need for adaptive measures discussed in more depth in Table 6.

Figure 7: Hospital locations with respect to the *urban heat island*



Access location of key decision-makers and frontline staff

5.13 Additionally, the location of many health service personnel is important, not only because the area at risk from tidal flooding is home to over a million residents and 500,000 properties (39) and will include health, social care, and other key workers. Tidal flooding will also threaten north-south transport routes across the length of the Thames in London, therefore inhibiting access, with additionally thirty eight underground and DLR stations at risk (See Figure 8). The same concern holds for management decision-makers, those involved in emergency planning, primary care workers and so on. With a concentration of decision-making organisations headquartered in Westminster. There is a risk of substantial disruption to top-down decision-making during a tidal flooding episode in the absence of adequate emergency communications plans or when alternative locations or communications are also affected (Figure 9).

Figure 8: Example of potential impact of flooding on river crossings

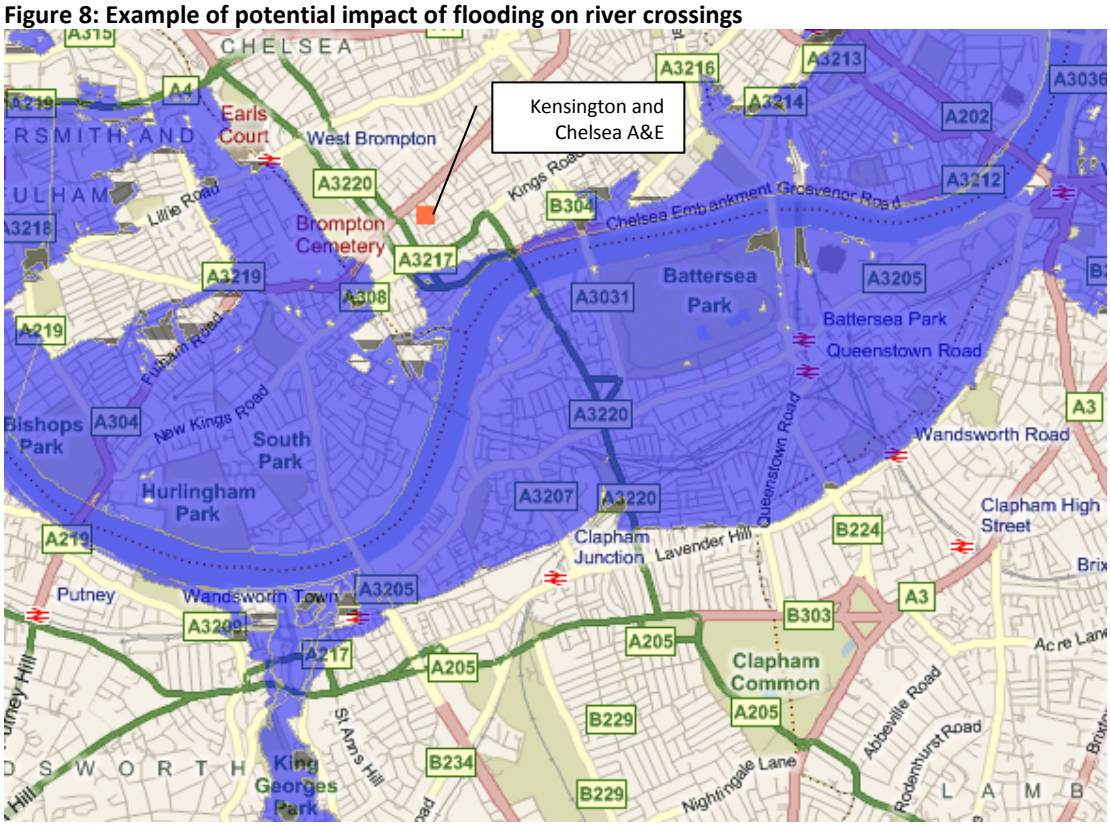
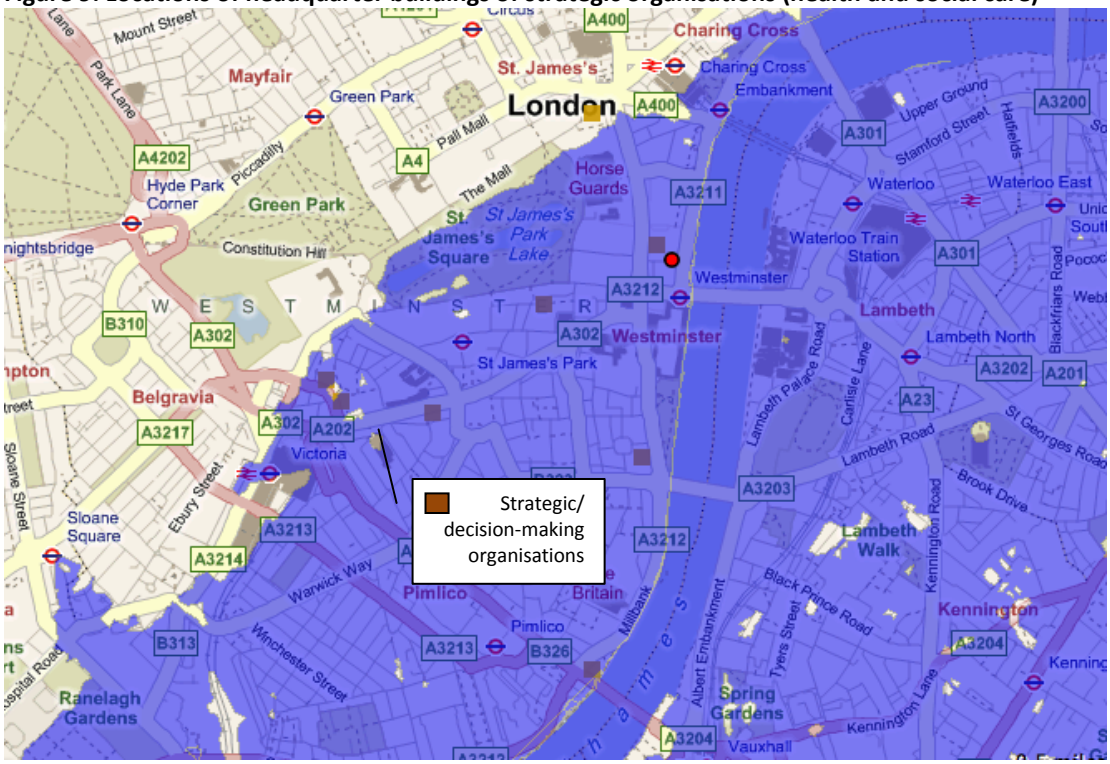


Figure 9: Locations of headquarter buildings of strategic organisations (health and social care)



Location of important supplies/ key nodal points in the supply chain

5.14 Availability and continuity of essential medicines and medical supplies is dependent on access and also affected by provenance (it is possible that the source location of a particular supply is affected by a climate impact). Increasing the resilience of the supply chain is therefore of great importance and needs to take account of London-specific access risks, including river crossings as well as the risks associated with the length of the supply chain. Figure 8 demonstrates the extent to which access would be restricted to Kensington and Chelsea A&E in the event of tidal flooding, with all local river crossings clearly affected (see Appendix 2 for further information on these data).

5.15 The NHS Sustainable Development Unit reported that 60 per cent of the carbon footprint of the NHS is associated with procurement (8). A focus on supply chain management therefore offers good potential both for climate change mitigation and adaptation.

Risk to energy and ICT infrastructure

5.16 Primary amongst the infrastructure needs for service provision is a reliable supply of power for medical equipment and ICT. The distribution network is particularly vulnerable during heatwaves when a surge demand for cooling can cause outages. At hospitals, electricity supply backup can be enhanced by many of the measures already promoted to reduce carbon emissions, such as the installation of combined heat and power units, which typically use natural gas and are therefore not at risk from electricity grid outages, and on-site renewable electricity generation, such as through solar photovoltaics. However, at present, many of the renewable energy generation choices are influenced by mitigation, rather than adaptation – so choices made tend to focus on the more efficient carbon abatement technologies such as ground source and air source heat pumps or solar thermal, which provide space and hot water heating efficiently – no less useful during an episode of flooding, but less so during a heatwave. Heat pumps, for example, can also be used for cooling, but the point serves to illustrate that adaptation considerations need to sit closely alongside mitigation ones, especially as there will be, in most cases, co-benefits from considering them together.

5.17 Against a backdrop of the ever increasing use of ICT in the provision of telemedicine (the provision of medical information via the internet or telephone) and health information, the

robustness and resilience of the wider communications assumes a greater importance. Communications and ICT partners need to be brought within emergency planning groups at a local level and the resilience to climate change of ICT, including the governance and workforce structures in place to support it, should become ever more central to decision-making.

Areas of risk for users of health and social care

Location of service users

5.18 On the service demand side, there are obvious implications for the health of an individual unable to access necessary services. Therefore data that can be assembled to help anticipate vulnerability from lack of access to services include car ownership (lower in inner London boroughs) and proximity to public transport. It is important to differentiate public transport types, with the underground more vulnerable to fluvial flooding, for example, and the overground more vulnerable to excessive heat.

Drinking water

5.19 For service users, access to drinking water is of critical importance during a climate-related crisis and therefore its maintenance through backup supplies at known healthcare locations is important. Longer term, the level of stress that water supplies are under in London and the Southeast will have consequences both for the risk of shortages at key moments of environmental stress (likely to coincide with increased levels of service demand) and for the continuity of 'business as usual' water use. The response should involve an increased emphasis on water conservation through simple technology, such as flow restrictors and low flush WCs and on more advanced measures such as rainwater harvesting for new builds and major refurbishments with the intention that key facilities should move towards self-sufficiency, especially with the southeast already under considerable water stress. Emergency planning for supply of bottled water needs to take account of supply routes.

A note on 'virtual water'

5.20 As a wider impact on health beyond its boundaries, the health service should also recognise 'virtual water' – i.e. the water demand of the whole-life cycle of its procurement – and the potential health implications of its contribution to water shortages elsewhere. Take cotton for example, which requires over 5,000m^3 per tonne if manufactured in China and over 20,000m^3 per tonne if manufactured in India (40). Much like the carbon emission attributable to the UK but not emitted there, the UK is putting other parts of the world under water stress through the products it procures.

Air quality

5.21 The Health Protection Agency (HPA) describe a number of environmental risks to health which, in the case of air pollution, overlap with the causes of climate change, including the effects of long term exposure to air pollution on mortality. While there is a decreasing trend for a number of important pollutants, the concentration of ozone is likely to increase due to higher temperatures. Table 1 on page 13 also shows that weather affects the distribution, seasonality and production of air-transported allergens. In its report *The Health Effects of Climate Change in the UK* (27), updated in 2008, the Department of Health notes the already increased incidence of heatwaves, with the 2003 heatwave of particular note, which led to the launch of its National Heatwave Plan which is reviewed annually (41).

Food

5.22 The greater the complexity in the supply chain, the greater the risk to the continuity of the *status quo*. Supply chains with an international reach are those at greatest risk, with food being the most obvious to be affected by climate, or geopolitical, events outside London. As one example, reduced export quotas from many rice producing nations have been attributed by many to climate change (42) implying that health care organisations should review food

procurement not just along carbon reduction lines - as encouraged by the NHS Sustainable Development Unit carbon reduction strategy for England (8) - but also along adaptation lines, taking account of the quantity and quality of available food during dry and hot and unusually wet weather in particular.

Responsibilities for risk management, mitigation and response: looking to the future

Management of flood risk

5.23 Management of flood defence falls to the Environment Agency, with a London Strategic Flood Framework providing guidance to responders 'before, during and after' a significant flooding incident (43). The local authority co-ordinated response for emergency planning in each borough involves PCTs and acute services, however the Health Protection Agency talk of a lack of confidence around flooding in part because vulnerable individuals are scattered and shifting and information about their locations cannot be completely accurate at any one time.

Managing water resources

5.24 The lessons learnt in Gloucestershire from the summer floods of 2007 (44) point to the need for very detailed planning within individual organisations and for the provision of clear expectations to suppliers of critical NHS supplies such as drinking water. In the case of the acute hospital at Cheltenham, mains water supply became unavailable due to flooding at the pumping station in 2007 and while the planned arrangement with the local water company were successful in achieving 13 tonnes of bottled water deliveries to the hospital, the manual transport of these from the site boundary to wards was left to hospital facilities staff – a difficult and unexpected demand on human resources. Concerns about legionella have influenced the way that individual NHS estates teams have approached its use – with fear about the disease leading to a reduction in storage and often a desire to draw water more, rather than less quickly, to keep water moving through pipes, particularly in older buildings. The importance of liaison with water companies cannot therefore be overstated.

Managing heat risks and air pollution

5.25 The Heatwave Plan for England (45) is not premised on the basis of climate change, but does make explicit reference to it. The Met Office provides the trigger for putting the Heatwave Plan into action but climate change projections do not feed into current thinking at the regional and local levels. This suggests that local NHS organisations will need to deal more regularly with events which are currently considered under emergency planning. Emergency planning will also need to alter its focus to increasingly extreme weather events. What is currently considered exceptional will become the anticipated norm.

5.26 Many reports refer to a reduction in air pollution over recent decades, but recognise that during hot weather, problems with build up of ozone, dust and fine particulates including PM_{10} and $PM_{2.5}$, amongst other pollutants, representing a significant problem for those with breathing difficulties. Whilst the increased windiness anticipated will often disperse pollution, this will not be the case during a heatwave which will be the result of a blocking high bringing anticyclonic conditions and hence low wind speeds. Policy decisions may be necessary to further restrict vehicle traffic in London during a heatwave.

5.27 Table 6 uses an example of a planned polyclinic, a key feature of *Healthcare for London*, to illustrate more specifically how existing practice for healthcare buildings could be further enhanced to address climate change impacts.

Table 6: Identifying climate resilience for a planned polyclinic in London

Climate impact (examples)	How the existing plans address resilience	Opportunities to further enhance resilience
Tidal Flood Event	Potential for increased service demand from Southeast of borough where EA flood zone 3 (as shown in the mapping application appended to this report) will directly affect homes in the Hackney Wick area.	The new polyclinic should consider the potential spikes in demand associated with flooding and identify appropriate or adaptable space within the building.
Pluvial Flood Event (surface water)	Data on distribution of pluvial impacts was not available for assessing the direct impact of surface water flooding on access or building services. Moderate stormwater attenuation is provided by a living roof comprising sedum and by porous paving to landscaping. Water conservation measures incorporated into specifications will reduce demand for treated water for non-potable services in the event that water supply is contaminated and therefore restricted.	Living roof with deeper growing medium will provide more stormwater attenuation. Stormwater attenuation could be designed into landscaping features (such as through detention or retention basins). Maximising vegetative cover, such as trees and vertical planting to building façades and the site boundary could help to delay stormwater reaching the drainage system.
Heatwave	Groundsource heat pumps are planned, which can be used to provide cooling. Solar photovoltaic (PV) panels planned and likely to perform optimally during anticyclonic conditions – providing a small contribution to ICT or cooling demands. Natural stack effect ventilation will be a by-product of the use of atria (designed to provide additional natural daylight). Manual control of cross-ventilation will be available. Best practice water efficiency standards are incorporated, such as waterless urinals, dual flush WCs and flow restrictors to showers and taps.	Heat pumps rely on electricity supply, so any power outage will affect potential for cooling. Solar PV supply will fall far short of energy demand for ICT and cooling. Alternative renewable electricity generation options limited, but could include connection to a local distributed network, building-integrated wind (unproven) and combined heat and power. Greater depth to living roof will provide more protection from heat. Green walls, particularly to the south face would provide additional protection. Rainwater harvesting and rainwater storage not included. While not suitable for drinking without expensive on-site treatment, would reduce pressure for external supply. 'Cool roofs' where sedum won't be planted and cool pavements could be used where possible to enhance solar reflectivity, thereby reducing the site's contribution to the urban heat island.
General	Encouragement of community groups to utilise available space in the building out of hours	Explicit focus, in partnership with the Local Strategic partnership and others to help build understanding and capacity of community groups to respond to climate change.

Implications for Action

- Provision of health and social care is diverse and dispersed, with an increasing emphasis on care delivered at home.
- Ongoing service planning needs to take account of climate change impacts on this evolving provider landscape. This includes:
    - Improved understanding of risk associated with health and social care delivery in people's homes as opposed to dedicated facilities, for example, isolation of vulnerable individuals, workforce mobility and dependence on ICT.
    - Ensuring climate change risks associated with designating fewer specialist locations are understood and addressed.
    - Identification, analysis and sharing of data to capture indirect and incremental climate related change and health impacts, for example the fitness of London's housing stock to cope with a range of projections.
- Emergency planning should be informed by climate change projections, particularly an increased incidence of extreme weather events.
- Co-benefits for health, climate change mitigation and adaptation can be realised by increased self-sufficiency of communities and local facilities, implementation of low-tech measures, and prioritising, for example, passive cooling and water conservation.
- There are efficiency and health gains to be made from procurement and supply chain management which is adapted to climate change.

6. How will the care pathways adapt?

6.1 Care pathways, also known as Integrated Care Pathways (ICPs), can cover the whole patient journey from, and back to, health or independence. More often than not the ICPs focus on only part of the journey that a patient with a particular condition takes, or is expected to take, through the system (46). Typically the focus is on secondary care.

6.2 Nationally ICPs differ in format: some standardise the documentation that different members of an inter-disciplinary team use to record their findings and treatment, while others map out the patient's anticipated journey and serve as a plan/guide to the care and treatment of patients (46).

6.3 NHS London defines an ICP *as a process within health and social care that collects variations between planned and actual care* (47) showing how the ICPs are an integral part of delivering services. As part of the reconfiguration of health services across the capital NHS London have 12 projects each of which will have strategic and specific care pathways (48).

6.4 We have seen that capital and infrastructure for health and social care will need to adapt to a changing climate in London. In this chapter we look at ways in which the commissioning and delivery of health and social care services will need to adapt to a changing climate. We look at the care pathway for long-term conditions (LTC) as an example, with particular reference to *Report of the Long-Term Conditions Clinical Working Group* (49) .

Why look at the sensitivity of the long-term conditions ICP with regard to climate change adaptation?

6.5 The care pathway for long-term conditions (LTC) addresses the needs of the most intensive users of health services, both young and old. The chronic nature of the conditions that come under this ICP means that it requires extensive interaction with social services.

6.6 NHS London chose diabetes as the focus of their long-term conditions project because of its prevalence in London, the poor standards of service offered in the capital compared with the rest of the country, and the huge variation in services in London (19). We saw in chapter 3 that many diseases, including disorders such as diabetes, are exacerbated by heat. People suffering from diabetes will be at particular risk during heatwaves as dehydration can occur when blood glucose levels are high, regardless of temperature (making it especially important to drink sufficient fluids in hot weather). It is instructive to consider how the ICP will need to adapt to a changing climate. The evidence (50) suggests that the best practice for long-term condition (LTC) management is remarkably similar across the major disease conditions. Table 7 examines the stages in the long-term conditions (LTC) care pathway, as described in the *Report of the Long-Term Conditions Clinical Working Group* (49), for sensitivity to changes in climate.

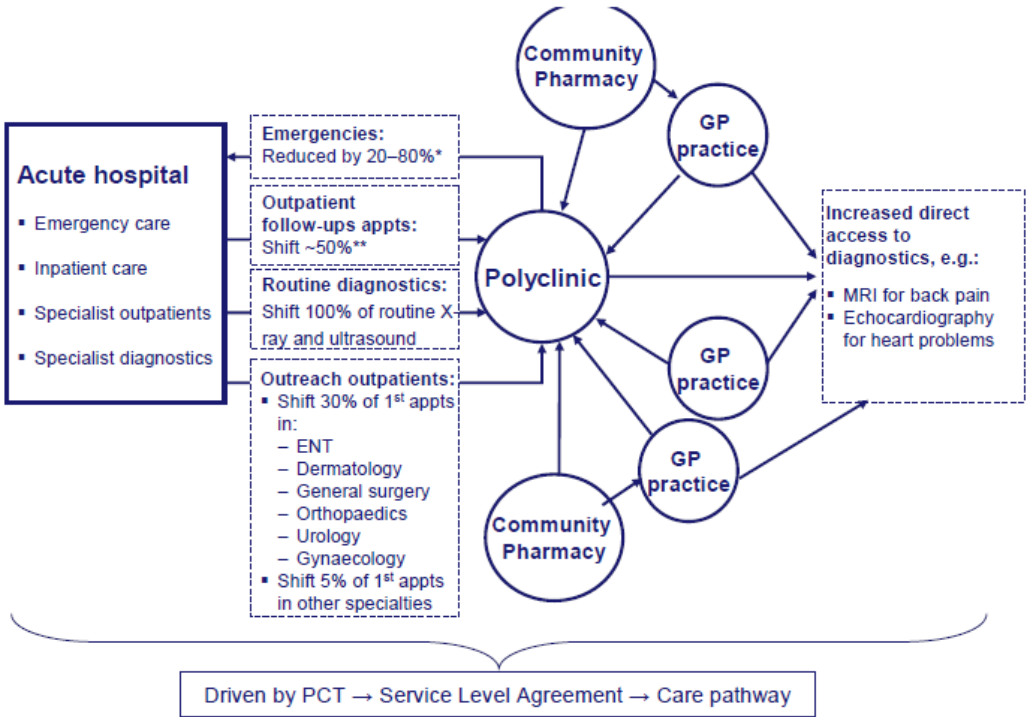
6.7 Figure 10 shows how long term conditions (LTCs) will be managed closer to home and that using centralised specialist hospital services will be used where necessary. The ICP is expected to reduce the burden on the Acute Hospital services as follows: Admissions to Accident & Emergency will be reduced by between 20% and 80%; routine outpatient appointments reduced by 50%; all routine diagnostics will be conducted closer to home; and outreach appointments will be reduce by up to 30%.

6.8 The Integrated Strategic Plan for *Healthcare for London* (19) describes the importance of addressing long-term conditions.

- Patients with long-term conditions account for 80% of GP consultations. A new model of care is needed in order to provide the best possible service to people with long-term conditions, and also to ensure the healthcare system can cope with demand in the future.

- The number of people with diabetes is particularly high in deprived areas and those with large communities from South Asian, African Caribbean or mixed ethnic backgrounds.
- At the same time, the information available to these communities about diabetes care is often lacking, especially for communities with large sections of non-English speakers. The project aims to enhance diabetes care in these communities, by providing better signposting and information in a range of languages, and by improving diabetes services in general.
- This will help *Healthcare for London* to realise one of its key aims – reducing health inequalities in the capital.
- London is also performing poorly when it comes to diagnosing diabetes. It is estimated that around a quarter of all sufferers may not be aware they have diabetes.
- Without change, the number of undiagnosed people will continue to rise – prevalence of diabetes is expected to increase as a result of an ageing population and unhealthy lifestyles.

Figure 10: The new model of care for Long Term Conditions



* Reductions achieved by better provision of long-term conditions management.

** Routine outpatient follow-up is with the GP unless consultant or patient chooses otherwise. Consultant sets out detailed care plan in letter to GP and patient.

From Howitt (49)

6.9 Table 7 is a commentary on the sensitivity of the pathway to climate issues, as it is currently conceived and described. The first three columns of Table 7 take text directly from the *Report of the Long-Term Conditions Clinical Working Group* (49). Each row corresponds to a stage as identified in the ICP. The shaded columns consider sensitivity to climate change. The headings from the last three columns are generic questions to address in the assessment of adaptation options (16).

- **Available:** Will current programmes and activities be sufficient to address any additional health risks of climate variability change? If not, what adjustments to these programmes and activities are needed? Where and when should these adjustments be implemented? Who is involved in implementing and maintaining these options? What human and financial resources are needed to implement these options?
- **Develop:** Are there new adaptation options that would increase resilience to climate change?
- **Research:** Are there options that could become available with research and development?

6.10 The findings in the table are indicative and will benefit from wider discussion and ownership.

Table 7: Long-term care pathway mapped against climate sensitivities

Stages in pathway, aims and actions from *Report of the Long-Term Conditions Clinical Working Group* (49)

Stage in pathway	Aim	Action	Climate sensitivity	Implications for adaptation		
				Available	*Develop*	*Research*
Assumption: The evidence (50) suggests that the best practice for LTC management is remarkably similar across the major disease conditions.			The assumption that the best practice for LTC management is remarkably similar across the major disease conditions needs to be tested for climate sensitivity.			Investigate climate adaptation options with respect to LTC management for each major disease conditions.
Prevention preventing LTCs	reducing smoking	ensuring all health professionals ask about smoking in their consultations with patients and can direct people towards appropriate support	Outdoor air quality Respiratory diseases and climate	Airtext sends real-time information about air pollution direct to Londoners, who register for the service, by text, voicemail and e mail (51).	Include urban heat island predictors into the coding for Airtext.	
		outreach for deprived groups			Continuing awareness, in commissioning, service delivery and scrutiny, of the profile of population groups settling in London, and their health and social care needs.	

Stage in pathway	Aim	Action	Climate sensitivity	Implications for adaptation		
				Available	*Develop*	*Research*
Prevention *cont*	decreasing obesity through better diet	ensuring all health professionals ask about diet in their consultations with patients and can direct people towards appropriate support	Availability of affordable, fresh and nutritious food	Incorporate climate change awareness in Hazard Analysis and Critical Control Point (HACCP) training for food safety; hard to influence behaviour; health education needs to be timed to coincide with adverse weather events/heatwaves (25).	Macro: food security for London population Micro: safe food production, storage and preparation in all climate conditions:	
	decreasing obesity through more physical activity	ensuring all health professionals ask about activity in their consultations with patients and can direct people towards appropriate support	Suitability of outdoor environment (built environment & temperature, humidity, air quality) for physical activity – proximity of green space	Climate information. Airtext sends real-time information about air pollution direct to Londoners, who register for the service, by text, voicemail and e mail (51). Information on coping during heatwaves (52;53). Information on staying safe during floods.	Real-time climate information sent directly to individual Green spaces accessible to all London residents Heat-related health information developed in advance (54). All health professionals able to advise on avoidance or reduction of heat exposure and recognition of relevant symptoms (54).	

Stage in pathway	Aim	Action	Climate sensitivity	Implications for adaptation		
				Available	*Develop*	*Research*
Prevention *cont*	decreasing obesity through more physical activity *cont*	outreach for deprived groups	Which population groups will require outreach? What other conditions/issues might they be experiencing? Will health professionals be appraised of surveillance information?	Care for vulnerable population groups	Funding, capacity and resources identified for providing care to vulnerable population groups (54) – particular care may also be needed according to LTC. PCT and community pharmacists to work on contingency plans to maintain access to medication, for example for mental health patients, in the community (44).	
		exercise/activity programmes (physical and mental) for people with mental health problems	Suitability of outdoor environment for physical activity – proximity of green space	Heat-related health information developed in advance (52;53) – special relevance to people suffering from diabetes, asthma and COPD and from poor mental health.	All health professionals able to advise on avoidance or reduction of heat exposure (54) during day and during night.	

Stage in pathway	Aim	Action	Climate sensitivity	Implications for adaptation		
				Available	*Develop*	*Research*
Prevention *cont*	decreasing obesity through more physical activity *cont*	cross-sectoral work e.g. in schools			Heat-related health information for children and teachers addressing, for example, safety during extreme weather events, cross-curricula work on environment and health, increased risks associated with illicit use of drugs and alcohol. Cool areas in schools. Outdoor shaded areas. Teaching staff and school nurses able to advise on avoidance or reduction of heat exposure during day and during night.	
Diagnosis easy and fast diagnostic access to tackle under-diagnosis	rapid access in the community rather than requiring patients to travel to the acute hospital for routine tests to be performed	For example ... 1 phlebotomy in every practice; 2 locally improved access to spirometry, with means to interpret data; 3 local MRI; and 4 local access to echocardiography and ultrasound.	Infrastructure for diagnostic services needs to be climate-proofed within the premises (e.g. ambient temperature of room housing the MRI scanner); security of power supply to the premises; flood-proofing.	Improve local access to diagnostic services in primary care.	Flood-proofing and heat protection of diagnostic equipment. Storage and disposal of samples needs to be climate-proofed. Security of power supply.	

Stage in pathway	Aim	Action	Climate sensitivity	Implications for adaptation		
				Available	*Develop*	*Research*
Diagnosis *cont*	rapid access in the community *cont*	For local diagnostics to be effective, accreditation and quality control will be needed to ensure that any diagnostic activity off the hospital site can be relied upon for clinical judgment.	N/A			
		A clear set of protocols to govern what tests are needed, under what conditions[2]	N/A			
		Interpreting an MRI scan for a child would need a specialist opinion) and when patients should be referred on to specialists.	N/A			
		Training and education will be needed for staff in the community to ensure they are aware of protocols and the availability of diagnostics.	N/A			
		Diagnostic results should be available quickly	N/A			

[2] for instance research has shown that in some cases radiography can be as effective as an MRI scan whilst being considerably cheaper see Jarvik et al (55)

Stage in pathway	Aim	Action	Climate sensitivity	Implications for adaptation		
				Available	*Develop*	*Research*
Empowering the patient Ideal care means putting the patient at the centre, in control of their care.	Self-management	Self-management education programmes[3]	London has a mobile population. Information, and outreach programmes, will need to adapt to meet the needs of new communities including *climate refugees*.	All health professionals able to advise on avoidance or reduction of heat exposure and recognition of relevant symptoms (54). Recognition of the importance of social, familial and other informal networks in enabling people to manage LTCs: these social networks will also increase resilience in extreme weather events.	Real-time health surveillance incorporated into the planning process.	Monitor population movements so that increases can be detected and responded to in a measured way (31).
		Expert Patient Programme, written care plans and self-monitoring – each approach is being evaluated (57).	As above			

[3] See the joint DH and Diabetes UK report on structured education for people with diabetes (56).

Stage in pathway	Aim	Action	Climate sensitivity	Implications for adaptation		
				Available	*Develop*	*Research*
Empowering the patient *cont*	Community pharmacies			Pharmacists are important and widely accessible sources of advice: they must able to advise on avoidance or reduction of heat exposure and recognition of relevant symptoms (54). Incorporate climate change awareness in HACCP training for pharmaceutical safety	Flood protection for pharmacies Security of power supply for pharmacies Secure the supply chain to pharmacies Work with the PCT and community pharmacists on contingency plans to maintain access to medication, for example for mental health patients, in the community (44).	
	Language and culture		Migration and population movement		Real-time health surveillance incorporated into the planning process.	Where will migrants to London be coming from?

Stage in pathway	Aim	Action	Climate sensitivity	Implications for adaptation		
				Available	*Develop*	*Research*
Primary and secondary care working together and with social services		Moves to earlier discharge and increased home based support will require shifts in funding from the NHS to social care agencies (22)	Suitability of home environment	Security of power supply	Summer health workforce planning, health service provision and training of health personnel and other interest groups (54). Care homes and hospitals meet the European Union criteria for the thermal indoor environment to prevent heat-related illness in patients and staff (54). Care facilities have security of power supply and are protected from floodwaters.	
			Food security and nutrition	Support service e.g. *meals on wheels* *And* voluntary sector e.g. Food Chain (HIV/AIDS)	Micro: safe food production, storage and preparation in all climate conditions Incorporate climate change awareness in Hazard Analysis and Critical Control Point (HACCP) training for food safety (25).	Macro: food security for London population

Stage in pathway	Aim	Action	Climate sensitivity	Implications for adaptation		
				Available	*Develop*	*Research*
Reducing hospital use	LTCs should be treated by doctors and nurses closer to patients' homes	the use of specialist nurses has benefits for people with LTCs such as asthma, COPD and heart failure in reducing emergency admissions and improving care	Workforce planning: how will staff be affected by extreme weather events? Suitability of primary care, and other locations, for providing care to people with LTCs.	People living with LTCs already managed their own care. Health and social care services need to enable people to make best use of services. The majority of care for people with common mental health problems is already provided locally – 90% are managed entirely in primary care.	Suitability of premises with regard to extreme weather events	
	Outpatient care for LTCs should be performed closer to patients' homes		As above		Suitability of premises with regard to extreme weather events	
	A&E needs to divert patients from the hospital to primary care to ensure continuity	A&E could alert the specialist COPD intermediate care team to treat the person at home	People suffering from LTCs will be sensitive to extreme weather events	Ensure that agreed care packages to handle acute deteriorations in a chronic illness take account of predicted weather events.		

Health inequalities and climate impacts

6.11 Climate change will adversely affect marginalised groups and is expected to increase health, and other, inequalities (17;18). *Healthcare for London* (19) projects future demand for, and provision of, health and social care services. It sets targets for the period 2010 to 2015.These projections and targets currently assume that the climate in London is a constant. While this is appropriate over the next five years it is clear that a longer term perspective needs to be developed and that climate needs to be considered as a variable in projections for health and social care services.

6.12 This will require both *active adaptation* and *autonomous adjustments* (27) to the planning and delivery of health and social care services. Simply put, "active adaptation" is that which is not spontaneous and requires decision-making, "autonomous adjustments" are spontaneous responses to incremental change such as physiological acclimatisation or behaviour change (drinking more fluids, say).

6.13 The *Healthcare for London* proposals operate to a relatively short timeframe but they have longer-term implications for services. We have seen above how climate change itself, and actions to adapt to climate change, may increase inequalities in health and in access to services. It is relevant to ask how care pathways can take account of inequalities in health. The IIA of Healthcare for London (20;22) calls for:

- an awareness of, and a focus upon, the needs of marginalised groups in commissioning, overview and scrutiny processes and in data-gathering; and
- accessibility of services to marginalised groups:
    - Information and care provided so that it is accessible to marginalised groups *e.g.* appropriate languages, culturally appropriate and using assertive outreach;
    - physical accessibility *e.g.* all primary, and other, care facilities to be fully DDA compliant; and
    - care to be delivered in an appropriate manner *e.g.* interpreters available for each patient contact and not just with the doctor.

6.14 The IIA of Healthcare for London (20) advised that commissioning decisions need to take account of, and to take steps to reverse, the inverse care law (21). People, and groups, who are marginalised or who have a lower socio-economic status tend to have lower usage of primary care and thus present later to healthcare services and have poorer outcomes. Apart from the fact that this maintains low levels of health it is an inefficient and resource intensive way of using healthcare services.

6.15 It is very important to ensure that proactive and intelligent outreach to marginalised groups and to communities newly settled in London becomes a core part of service delivery.

Good practice case studies

6.16 The figures below take examples of good practice in London as described in the *Report of the Long-Term Conditions Clinical Working Group* (49) and consider some ways in which these services will need to adapt for the projected changes in London's climate, taking excessive heat as an example.

6.17 Figure 16 reports on an example of good practice in France where the health surveillance systems have been adapted to take account of climate change.

Figure 11: London: good practice - exercise on prescription/bibliotherapy

In Kensington and Chelsea PCT a programme to provide exercise on prescription and bibliotherapy for people with depression and anxiety has had great success. People who otherwise would have required medication are treated drug-free, in line with NICE guidelines.

Opportunities for climate change adaptation: heat

- GPs receive accurate and timely alerts regarding heatwaves.
- Real-time information provided to patients on heatwaves and air quality (Airtext adapted to incorporate information on heat).
- Information provided to patients in ways that are accessible to different population groups.
- Information given to patients on ways to reduce heat exposure indoors and outdoors and how to recognize heat related symptoms: one of the effects of intense and prolonged heat is to affect decision-making capability so people with poor mental health are particularly at risk.
- Patients provided with directions to cool areas within the city such as parks and green spaces.
- Joint commissioning of maintenance of, and activities, in cool areas parks and green spaces.
- Drinking water freely available in parks and green spaces.
- Library design (and other locations for bibliotherapy) take ambient temperature into account.
- Drinking water freely available in libraries (and other locations for bibliotherapy).
- Specific outreach programmes needed to groups of Londoners with particularly high rates of mental health problems including refugees and asylum seekers, homeless people, and those who misuse alcohol and drugs.

Adapted from Howitt (49)

Figure 12: London: good practice - direct access spirometry

Hammersmith and Fulham PCT and Imperial College set up a Community Respiratory Assessment Unit. This was a central and peripatetic nurse-led service (58). This provided local access to spirometry and helped to ensure that national guidelines were followed. 88% of GPs involved thought their patients had benefited or greatly benefited from the service. Without the Assessment Unit there would have been more referrals to hospital outpatients and more prescriptions of courses of drugs.

Opportunities for climate change adaptation: heat

- Air quality is affected in times of heatwave.
- Community Respiratory Assessment Unit receives accurate and timely alerts regarding heatwaves and air quality.
- Real-time information provided to Community Respiratory Assessment Unit on heatwaves and air quality.
- Real-time information provided to patients on heatwaves and air quality.
- Information given to patients and to health care professionals on ways to reduce heat exposure indoors and outdoors and how to recognize heat related symptoms.
- Locations for service delivery are capable of maintaining a cool ambient temperature and have a secure power supply.
- Locations for service delivery remain accessible in times of heatwave. Staff and patients are able to travel to locations for service delivery in times of heatwave.
- The direct access spirometry service will need to ensure that it is accessible to and used by people who are newly settled in London. Proactive and intelligent outreach must be required and supported.

Adapted from Howitt (49)

Figure 13: London: good practice - using technology & diabetes education for non English speakers

Using technology The NEAT diabetes project, funded by the London Borough of Newham Social Services, involves the use of t+, a text messaging service developed by E-San, allowing patients to download blood sugar readings and text it through their mobile phones.
The t+ diabetes system product consists of a GPRS mobile phone, a One Touch Ultra meter and a Blue Tooth cradle. As soon as the reading is taken, the phone display provides immediate feedback represented as a bar chart or scatter graph, whilst also sending data to a secure server where it is stored with previous readings. The results are further processed and sent out as a printed monthly report to the diabetes sufferer. Readings can also be viewed via a secure web page (59).
This is read by a diabetes specialist nurse based in hospital, who texts/calls back with appropriate advice. The project is aimed at improving care for women with antenatal diabetes by reducing the frequency of outpatient attendances and providing aggressive management of blood sugar levels by the diabetes nurse. The clinical and biochemical outcomes are being evaluated, but one interesting finding was that most women from ethnic minority groups had the latest mobile phone with GPS required for this service.

Opportunities for climate change adaptation: heat

- Real-time information provided to the NEAT diabetes project on heatwaves and air quality.
- Real-time information provided to patients on heatwaves and air quality.
- Information given to patients and to health care professionals on ways to reduce heat exposure indoors and outdoors and how to recognize heat related symptoms.
- Ongoing monitoring, incorporating climate information, into coverage of NEAT project.
- Security of telecommunication system. Security of power supply.

Diabetes education for non English speakers. This is being funded by the NHS Service Delivery and Organization Research and Development programme (SDO) to develop the role of bilingual health advocates (BHA) who provide diabetes education in the community for patients who do not speak English. The BHA are community workers who are offered six months of accredited training and then provide group education, with input from health professionals as required, for patients with diabetes (though this model could be rolled over to other LTCs, if successful). This is being compared to standard health professional led education and clinical, biochemical, wellbeing and organisational impact is being measured. Further details at:
www.newhamuniversityhospital.nhs.uk/poseidon

Opportunities for climate change adaptation: heat

- Climate change adaptation and information on heatwaves is an integral part of BHA training.
- People with diabetes are vulnerable to heatwaves: information must be developed and provided in appropriate languages and formats.
- BHAs linked with, and drawn from, newly arriving communities.
- BHAs feed back to mainstream service providers information about adaptation behaviours and needs.
- The increased importance of locally produced food will mean that food which is culturally appropriate for non-English speakers may be more expensive and harder to source. Nutrition and dietetic advice will need to take this into account. This is also considered on a pan-London policy level.

Adapted from Howitt (49)

Figure 14: London: good practice - community diabetes consultant and shared care

Community diabetes consultant. Newham have used a community diabetes consultant for about eight years, who supervises and supports the GPs with special interests (GPwSIs) and community specialist nurses who provide diabetes clinics closer to patient's homes. There is a central referral triage system and referrals are allocated according to guidelines to community clinics or secondary care specialist services. The community clinics are staffed by GPwSIs and specialist nurses, and teaching, training and supervision is done by the GP diabetes lead and community consultant. This also allows clinical mentoring and governance.

Opportunities for climate change adaptation: heat

- Primary care premises in general, and the larger polyclinics in particular, are exemplar developments which can act as refugia for sensitive populations, such as people suffering from diabetes, in times of heatwave: cool, green shaded external areas and naturally regulated, and cool, indoor environments.
- All primary care premises have secure power supply and secure telecommunications.
- The community diabetes consultant, the GPwSIs, and the community specialist nurses link with other outreach projects to ensure that people with diabetes are aware of heatwaves in advance and that they know how to avoid the heat and what to do in case of emergency.

Shared Care. Hammersmith Hospitals NHS Trust has an innovative strategy that "shares care" between primary and secondary care. Four years ago they developed a multidisciplinary multiple sclerosis (MS) clinic in the community. Without any additional funding, all the relevant healthcare professionals got together as a group to discuss patients they would have normally have seen separately. Just breaking down primary/secondary care barriers in this way has brought big gains in patient care. A recent audit has demonstrated that inpatient bed occupancy for MS patients has reduced by 34%. The clinic was awarded a national innovation award for patient care by the UK MS Society in 2005. The trust is now looking to develop a similar approach for other chronic neurological diseases.

Opportunities for climate change adaptation: heat

- Implications of increased ambient temperature and extreme events for people with MS, and other chronic neurological diseases, to be discussed in shared care groups.

Adapted from Howitt (49)

Figure 15: London: good practice - an effective care model in the community

The Brent integrated cardiology model combines case management, easy access diagnostics, local clinics and patient support. Particular aspects include:

- A 'community cardiologist' currently provides three general cardiology clinics and one cardiovascular risk and hypertension clinic in two venues in different parts of Brent. A third venue will become operational in the near future.
- The heart failure clinic at Wembley has its own echocardiography service ('Echotech').
- Specialist cardiac nurses case-manage patients in the community, which includes telephone consultations and home visits. Cardiac rehabilitation is coordinated by the nurses and they provide support and guidance to the two patient support groups.
- A training programme was implemented at the end of 2005, coordinated by the community cardiologist whose remit includes one training session per week. Initially aimed at GPs, the training programme is now attended by members of the wider multidisciplinary team and patients. There are two sessions per month, one in the afternoon and one in the evening, in order to reach a wider audience. Speakers have included local clinicians, both doctors and nurses and 'international' speakers. Sessions are very well attended and the feedback has been excellent.

Opportunities for climate change adaptation: heat

- The equipment that cardiac nurses are required to take on home visits is designed to be highly portable and easily carried.
- Cardiac nurses visit patients on foot, by bicycle, public transport or by electric car.
- Cardiology, and other, clinics are provided in locations that are highly accessible. Transport for London and health bodies, such as Strategic Health Authority, the Primary Care Trust and hospital trusts, ensure that no patient needs to use private motorized transport to get to a clinic. GPs discuss transport with patients.
- No NHS staff member is required to own a car for work. NHS staff walk, bicycle, use taxis and public transport and, where essential, cars from a carpool.
- Land that was used for car parks is developed or turned into green space.

Adapted from Howitt (49)

Figure 16: France: good practice - adaptation needs for health surveillance systems

In France, risks likely to be modified by climate change are already monitored. The projected impacts of climate change do not justify the implementation of dedicated surveillance systems. However, existing systems could be strengthened, e.g.

- ensure data quality, availability and homogeneity through time ;
- improve data linking between environmental and health surveillance systems;
- do systematic and standardised analyses of extreme events, taking into account the short and long terms impacts, including mental health;
- use syndromic surveillance to follow unexpected events (syndromic surveillance systems seek to use existing health data in real time to provide immediate analysis and feedback to those charged with investigation and follow-up of potential outbreaks (60));
- take into account the influence of behavioural change onto exposure; and
- reinforce vector surveillance capacity for timely alert.

There is a need for closer collaboration between surveillance institutes and research to get a broad view of the potential impacts of climate change e.g.

- develop a better understanding of the role of climate and climate variability on environmental health and on infectious diseases;
- develop tools to follow-up and evaluate the impacts of mitigation and adaptation strategies
- develop new approaches to characterise exposure. Climate change could result in environmental and social changes that may modify exposure patterns; and
- define scenario to feed downscaling models and develop impact models at the regional scale.

From Pascal et al (61)

Implications for Action

- There are opportunities and risks associated with the development of the new integrated health and social care pathways.
- Adaptive actions identified for the Long Term Conditions pathway could readily be applied to the other pathways.
- Clinical engagement in pathway design and guidance can be harnessed to develop and promote good practice in climate change adaptation.
- Integrated Impact Assessment of the pathways could help ensure that health inequalities are not exacerbated by climate impacts.
- The importance of surveillance and real-time information for patients and professionals should be underlined; and will require training, awareness-raising and resources.
- Adaptive actions should be targeted at vulnerable and marginalised groups.

7. Conclusions and recommendations

7.1 In reaching our conclusion, we draw on the evidence and reflections within our report and supplement this with knowledge and experience of the planning, development and assurance processes followed by regional government, local government and the NHS.

7.2 Throughout the report, we have highlighted what we describe as "implications for action". Given the multiple determinants of individual and population health, these are implications for a range of stakeholders. In particular, they point to a strong need for more concerted action between those directly responsible for London's health and social care and those with expertise and interest in climate change adaptation. Health inequalities in London are such that we underline the particular imperative of ensuring that there are no perverse consequences of climate adaptation measures at the expense of those with greater health needs or who live in more vulnerable circumstances. Again, partnership-working across sectors will be key.

7.3 The fact that this report was commissioned jointly by health, social care and adaptation colleagues is a welcome beginning.

7.4 The specific recommendations we set out below are the building blocks for an Action Plan which will require not only cross-sector expertise but also sign-up at the highest level. The development of such an Action Plan is timely as we approach the season for refreshing Joint Strategic Needs Assessments, community strategies and, later, commissioning strategies. There are complementary roles for policy and development bodies, on the one hand, and assurance and regulatory bodies, on the other, to encourage and enforce improved climate adaptation practice.

7.5 Our recommendations are chiefly for regional and strategic organisations in these capacities, and we also point up the responsibility to share learning and to learn from the experience of private and voluntary sector providers and from communities, patients and service users themselves.

7.6 Where we point to roles at a local level, the regional "position" and capacity to support should be taken into consideration.

7.7 It is also worth noting here that the NHS in London is currently undergoing one of its not infrequent restructures. Borough-level Primary Care Trusts are working closely with their neighbours at a sub-regional or "sector" level and more formal integration is anticipated. The implications for this and for healthcare for London of the General Election (May 201) are unclear. During this period of transition, NHS London will be aware of the need to ensure that sector as well as local communication routes and responsibilities are reflected in actions agreed.

Strategic risk assessment

7.8 At a national level, the newly published Department of Health Climate Change Plan has identified four strategic risks which it seeks to address:

- Local service planning and design do not take climate change evidence and impacts into account.
- Provision of local health services does not match demand for increased range/ type/scale of diseases.
- Resources are not prioritised and allocated effectively to take account of climate change evidence and impacts.
- Policy development design does not take climate change evidence and impacts into account.

7.9 We recommend that these same risks should inform the development of London's action plan also.

Awareness raising and key messages

7.10 Given the low level of awareness of climate change adaptation risks and opportunities, we recommend that suitably targeted awareness raising should be a priority. There are roles here for those in leadership positions, such as the Mayor of London and the Chief Executive of NHS London; but also a place for local leaders and community organisations to harness local knowledge and energy. We recommend that:

- LCCP encourages the Mayor of London to use his influence and raise the profile of climate change adaptation with London's health and social care sector.
- LCCP works with Government Office for London, and regional health and social care colleagues to develop and disseminate brief statements of the "health business case" for adaptation, targeted respectively at health, adult and children's services and local resilience fora.
- LCCP works with Government Office for London and regional health and social care colleagues to supplement the "health business case" with practical guides and "top tips" for strategic and commissioning stakeholders and provider organisations.
- NHS London, Regional Public Health Group and the Regional Social Care and Partnerships team support and encourage local organisations to work with the community sector to raise awareness of climate risks and personal adaptation strategies, particularly among marginalised communities. Where possible, this should build on existing programmes such as public health harm reduction programmes and voluntary sector initiatives such as The Big Response (62).

Data, mapping and surveillance (see also Appendix 2 and recommendations regarding Climate Risk Mapper)

7.11 A wealth of data (and analytical expertise) are available on climate change projections and on the wider determinants of health. However, these are not presently accessible via a single portal for London. Additionally, there is a need for further work to analyse the interrelationship of these data in order to improve understanding of potential climate impacts. We recommend that:

- The GLA and Commissioning Support for London (London Health Observatory) develop a regional data repository to help inform risk analysis and Joint Strategic Needs Assessments within the health and social care sectors, with a particular focus on vulnerable populations.
- Government Office for London, Regional Public Health Group and Social Care and Partnerships develop guidance for local strategic partnerships on building climate impacts into Joint Strategic Needs Assessments. This would probably best be delivered as combined guidance on climate change mitigation in order to maximise the likelihood that climate change will become a feature of JSNAs where it is not currently prominent.
- The GLA and Commissioning Support for London (London Health Observatory) map and interpret the effects of climate changes on the wider determinants of health, such as housing, in order to better establish the location of at-risk populations previously hard to identify, detect new trends and risk factors.
- NHS London and London Councils work with the NHS sectors (sub-regions), primary care trusts and local authorities to deploy data above to support decision-making about the configuration (and reconfiguration) of future services.
- NHS London, the Health Protection Agency and London Resilience work with local authorities and health trusts to strengthen health surveillance capabilities with respect to climate risks, offering real time information and advice to professionals, patients and service users.
- NHS London continues to build on the opportunity presented by the 2012 Games to consider the implications of maintaining accurate and useful health surveillance of a large movement of people from many destinations.

Clinical engagement, commissioning and service design

7.12 Healthcare for London presents opportunities and risks for climate change adaptation, through its focus on care closer to home, on the one hand, and centralising specialist hospital services on the other. We recommend:

- NHS London and Commissioning Support for London should build climate impacts into the model Healthcare for London care pathways and gather good practice to inform this. Specifically, they should seize the opportunity presented by the new work being scoped for the Staying Healthy pathway.
- Health and social care commissioners should seek to optimise the benefits of telehealth and telecare by planning for climate impacts on ICT, possibly incentivising innovation by provider organisations.
- Commissioners should require intelligent and assertive outreach to marginalised groups, including people who are newly settled in London (with respect to climate change adaptation).
- Commissioning Support for London, London Councils, Capital Ambition and the Joint Improvement Partnership should work with local commissioners to help develop service contract specifications with regard to adaptation.
- Commissioners should be encouraged by NHS London to explore options for requiring adaptation measures in the context of the CQUIN element of service contracts (Commissioning for Quality and Innovation), possibly as a pilot.
- LCCP should consider the option to invest resources in testing all of the above via an "exemplar climate adapted polysystem".

Service standards

7.13 Minimum standards for care and quality are set nationally by the regulators, specifically the Care Quality Commission. These do not currently reflect climate change projections and good practice in adaptation. We recommend:

- Regional bodies work together to encourage central government and the regulatory bodies to include adaptation requirements in national service standards, deploying advocacy, influence and persuasion as appropriate.
- Regardless of the above, Government Office for London and regional health and social care stakeholders work with regional and local provider organisations to develop best practice in climate adaptation and address any barriers to improvement. See also above regarding contract specifications and incentives.

Built environment

7.14 While the present financial climate may lead to fewer new facilities than previously anticipated, there is nonetheless a major programme of work to build or redevelop community based provision, particularly polyclinics. We recommend:

- Primary Care Trusts ensure new polyclinics have a strong role in enhancing community resilience – both as refugia during major weather events and as potential contributors to sustainable community energy schemes.
- Primary Care Trusts and local authorities, where possible, identify suitable opportunities to co-locate services in order to make a more rapid transition to a more resilient building stock.
- NHS London, Government Office for London, Regional Public Health Group, Social Care and Partnerships and the Joint Improvement Partnership work together to identify and address areas where climate change mitigation measures could come at cost to adaptation measures – ensuring complementary or mutually supporting strategies.

- NHS London (Strategic Estates) actively promotes to Primary Care Trusts sustainable urban drainage, urban greening, and wider principles of biomimicry as ways to reduce the impact of climate change on health and social care buildings and users.
- As with service standards above, regional bodies work together to advocate for national or produce regional supplementary guidance to ensure that new buildings and major refurbishments are taking adequate account of adaptation measures through BREEAM assessments and other mechanisms, likely to include a stronger emphasis on the 'Health and Wellbeing' scores within the assessment.

Emergency planning

7.15 Emergency planning does not yet take full account of projected climate change, particularly the increased incidence of extreme weather events. However, information, advice and expertise do exist nationally and internationally. We recommend:

- NHS London and London Resilience "climate change proof" emergency planning to ensure adequate to changing patterns and frequency of extreme weather events, and work with local resilience fora to build community capacity.
- NHS London and the Host boroughs take the opportunity presented by the 2012 Games to learn international lessons and enhance responsiveness to climate-related impacts.

Capacity-building and workforce development

7.16 Saving Carbon, improving health has raised awareness of climate change mitigation responsibilities across the NHS and there is some resourcing at national level to build the capacity of the public health workforce in this area. A pan-London NHS carbon reduction enabling strategy is being developed, which will span commissioning, estates and facilities and healthcare provision. A network of operational leads has been established to facilitate good practice sharing and build capacity. Local authority colleagues are involved. No equivalent programme has been established for climate change adaptation, and both awareness and capacity are relatively low. We recommend:

- NHS London, Regional Public Health Group and Social Care and Partnerships, London Councils, the Joint Improvement Partnership and London Climate Change Partnership consider how best to develop and support a regional enabling strategy which is integrated with or complements the carbon reduction strategy.
- More generally, the NHS should build on existing public health climate capacity programmes to ensure adaptation as well as mitigation is addressed, and extend to the wider workforce including social care and independent providers.

Procurement

7.17 The contribution of public sector procurement to carbon emissions is well documented, and, rightly, the focus of action to mitigate its impact. In itself, this provides an obvious platform for action also to adapt to climate change. However, our report is clear that procurement and supply chain management are potentially vulnerable to the impacts of climate change, demanding action in their own right. We recommend:

- LCCP works with regional health and social care stakeholders and Capital Ambition to develop guidance for ensuring climate impacts are included in risk assessments for key products in the supply chain.
- LCCP encourages regional and local stakeholders to exploit the widespread food-related initiatives in London, which are mainly oriented to carbon reduction, to strengthen the resilience of the supply chain – also achieving co-benefits for mitigation and health. This could be in partnership with the London Health Commission and London Food, for example.

8. Appendices

Appendix 1: A list of interviewees and those who provided informal advice

The following people were consulted in the preparation of this report:

- Faraz Baber, Director, World City, London Councils
- Jared Boow, Policy and Project Manager (Environment), London Councils
- Bevan Jones, Climate Change Adaptation Officer, London Borough of Islington
- Richard Laurence, Group Head of Clinical Performance, Care UK
- Paul Plant, Deputy Regional Director for Public Health, Regional Public health Group – London
- Honor Rhodes, Director of Projects & Strategic Development, Tavistock Centre for Couple Relationships
- James Reilly, Director of Adult Services, London Borough of Hammersmith & Fulham
- Hilary Ross, 2012 Programme Director, NHS London
- Andy Wapling, Head of Emergency Preparedness, NHS London
- Deborah Williams, Children and Young People, NHS London
- Michael Wilson, Assistant Director, Prevention and Wellbeing, Commissioning Support for London

We would also like to acknowledge the informal contributions of

- Jane Durney, Team leader, Commission for a Sustainable London
- Bettina Menne, Medical Officer, Global Change and health, WHO

Others were approached.

Appendix 2: Climate Risk Mapper

Using this map viewer application

8.1 This application gives instant access to data helping to visualise the locations of health and social care provision in the context of projected climate change risks. To access the application, please visit http://beta.geofuturesonline.com/GLA and enter the login details.

8.2 **Browser standard:** As with all applications visualising semi-transparent surfaces, this tool cannot be effectively viewed in IE6 (for which Microsoft has now withdrawn support). All other major browsers (IE7 and above, Mozilla Firefox and Safari) should allow the application to be viewed correctly.

8.3 **Organogram:** The first screen shows an organogram of core functions in London's health and social care provision. Hover over each box to see a short explanation of the roles of each. Click 'Go to map' to access the map viewer. Click on 'Go to organogram' to return to this page.

8.4 **Map controls:** Pan around and zoom into / out of the map using the controls at the top left of the map, or click, hold and drag the map with the mouse.

8.5 At the top of the map, you can choose between 'Road' [map], 'Aerial' or 'Bird's Eye' [oblique aerial photography] as map backgrounds.

8.6 **Data selections:** Contextual data has been visualised as data surfaces. Data values are statistically 'smoothed' using spatial interpolation methods to allow the data to appear as a continuous surface. Point data shows specific locations within the different categories of care provision, and each category can be viewed on top of contextual data and together with other categories.

8.7 To select data to view on the map, check the relevant box on the right hand side.

8.8 Note that contextual datasets selected with ◉ circular radio buttons can be viewed together with point data, but not alongside other data surfaces (which together would become unintelligible). Datasets selected with ☑ checkboxes can be viewed in combination with others. When data points are displayed on the map, click on an icon to see the details of that location displayed on a pop-up label.

Notes on the data

8.9 **Flood data:** Flood zone data is sourced from the Environment Agency. Two flood zones are shown:

- floodzone 3 (assessed as having a 1% or greater annual probability of fluvial flooding or a 0.5% or greater annual probability of tidal flooding)
- floodzone 2 (assessed as having an annual probability of fluvial flooding between !% and 0.1% and an annual probability between 0.5% and 0.1% of tidal flooding).

8.10 Important to note for both flood zones is that:

- Neither take account of the presence of flood defences
- Neither take account of projected climate change i.e. they express current flood risk from river and tidal flooding.

8.11 Whilst it is a limitation of these datasets that they do not include projected data taking climate change into account, the flood zones still usefully express the areas of London which would be flooded in the event that the Thames Barrage was breached, for which climate change would most likely be responsible. Floodzone 3 also provides insight into those areas most at risk in current conditions, and floodzone 2 gives an indication of which would be the locations at risk from a growing likelihood of fluvial and sea flooding.

8.12 **Climate data:** Climate data is sourced from the Defra-sponsored UK Climate Impacts Programme (UKCIP), which models probabilistic climate projections at a resolution of 25km, based on low, medium and high emissions scenarios developed by the Intergovernmental Panel on Climate Change (ICPC) in 2001.

8.13 These scenarios can be summarised as follows:

- **Low**: based on ICPC scenario B1 –
    - Rapid economic growth, but with rapid changes towards a service and information economy.
    - Population rising to 9 billion in 2050 and then declining.
    - Reductions in material intensity and the introduction of clean and resource efficient technologies.
    - An emphasis on global solutions to economic, social and environmental stability
- **Medium:** based on ICPC scenario A1b –
    - Rapid economic growth.
    - A global population that reaches 9 billion in 2050 and then gradually declines.
    - The quick spread of new and efficient technologies.
    - A convergent world - income and way of life converge between regions. Extensive social and cultural interactions worldwide.
    - A balanced emphasis on all energy sources.
- **High:** based on ICPC scenario A1F1 –
    - As A1b but with a continued emphasis on fossil fuel technology.
    - All climate data is projected here for the 2020s, 2040s and 2080s.

8.14 **Winter rainfall:** This dataset is sourced from UKCIP, and is selected for this application on the basis that peak seasonal rainfall is more likely to impact health care provision than an overall annual rainfall increase, of which SE England faces less risk than western regions.

8.15 Figures are expressed as a percentage increase over a 1961-1990 baseline.

8.16 **Summer temperature:** The projected temperature on the warmest day is used here. As for winter rainfall, this data gives us an insight into the type of extreme weather events most likely to impact Londoners over the next century. SE England is predicted to experience considerable increases in peak summer temperatures, and the effects of heatwaves are exacerbated by high building density (see below).

8.17 Figures are expressed as a degrees Celsius increase over a 1961-1990 baseline.

Other contextual data

8.18 **Population projections:** This data is sourced from Office for National Statistics' Neighbourhood Statistics (NESS), and is included to illustrate those London boroughs most likely to experience health and social care resource pressure alongside climate change impacts due to rapidly increasing populations. Projections are only available to 2030, so the application allows viewing of changes at 5-year intervals from 2010 to 2030.

8.19 City of London is not included in population projections by ONS "as the projections produced are not robust enough for such a small area".

8.20 A straightforward refinement of this data given additional time and resources would be the addition of visualisations of the oldest sections of the population for each borough projected through time, since older residents are more likely to be at risk from health impacts from climate events and may have less adaptive capacity.

8.21 **Limiting long-term illness (LLTI):** This data from Office for National Statistics is Census-based and has been spatially smoothed from small census areas (lower super output areas) to provide a basic insight into those parts of London where higher proportions of the population suffer long-term health issues, helping again to highlight locations where climate change

health impacts may be most severely felt and where adaptive capacity may be reduced. LLTI is not tightly defined in Census data releases, only representing "any long-term illness, health problem or disability that limits daily activities or work"; for England and Wales in 2001 this applied to over 18% of the population.

8.22 Unlike some Census-based data this is only updated every 10 years, so LLTI can only reflect conditions in 2001 until the 2011 Census results are released.

8.23 **Ethnic minorities:** Basic data is included here expressing the percentage of each lower-super output area (LSOA) who describe themselves as of black, Asian or other minority ethnic origin. Data is sourced from ONS NESS.

8.24 To provide full insight into the potential influence which ethnicity may have on susceptibility to disease, community cohesion, ability to receive and follow emergency communications and other aspects of adaptive capacity would require finer levels of ethnic differentiation, led by existing strategy directions. This is a clear opportunity to enhance the data included.

8.25 **Building density:** Work is in progress for GLA led by UCL to model the effects of London's urban heat island, the combined effects of building density, building height, the wind rose and other built environment factors which can increase air temperature in urban areas by several degrees relative to outlying areas. Heatwaves are projected to become more common for London as the climate changes, and the effects of the heat island are likely to create significant spatial differentiation in the temperature experienced by the population in different parts of the capital, and hence the health impacts.

8.26 Since this data was not made available to us for this study, we have included a building density surface based on Ordnance Survey's AddressPoint dataset, the best available proxy to illustrate areas most likely to witness extreme urban heat. In reality the peak areas may be attenuated across north-east London reflecting the prevailing wind direction from the south west, but in light of the fact that the outputs of a full heat island model are available to GLA, no attempt has been made to adjust this building density dataset accordingly.

8.27 Heat retention by buildings is in part a function of building height, which tends to increase thermal mass and surface area. AddressPoint give a x,y co-ordinate for every unit address, creating a data hotspot where high-rise blocks house many addresses. This is some substitute for full 3D modelling in determining locations most at risk from summer heatwaves, though clearly a limitation relative to data which may become available.

8.28 The inclusion of GLA's full heat island modelling outputs is a clear opportunity to enhance the climate risk mapping application.

Point data

8.29 **PointX location data:** Most point data has been sourced from Landmark / Ordnance Survey's PointX database. The categories therefore reflect OS's nomenclature and data capture methods, and those selected have been chosen as the best available summary of locations relevant to provision of all aspects of health and social care across London.

8.30 PointX data is collected for the purposes of supplying points of interest data to applications such as satellite navigation systems. This creates limitations which always arise when data collected for one purpose is used for another: for example, a hospital may appear as two points reflecting two main entrances, information which is most relevant to a taxi driver but may not adequately reflect the building's true spatial location at fine scales.

8.31 It has the advantage of being highly comprehensive, but this in turn may lead to locations being included in a data category such as 'hospitals' which may fit into the broadest possible definition of this term, rather than reflecting the NHS' or other bodies' internal naming conventions. We aimed to get around this by providing the point and click location tag, avoiding users of the application being misled by the location of a building which turns out not to be strategically significant.

8.32 **Address data:** Three categories of point data are sourced separately:

- Home care agency addresses from the Care Quality Commission. Given their geographic spread, this dataset comes as close as we may get to defining the home locations where much social care is delivered. This and all address data is located by the centroid of the unit postcode.
- The locations of headquarters of Primary Care Trusts, based on their address data. A PCT head office which is disabled in an extreme weather event may compromise the standards of care given by bodies under its jurisdiction, especially emergency provision.
- The locations of the headquarters of the health bodies listed on the organogram from address data as above. The same applies to weather impacts on regional and national headquarters which require adaptation planning themselves.

Note on options for future development of Climate Risk Mapper

8.33 The aim of Climate Risk Mapper is to enable decision makers to visualise instantly the spatial distribution of these risks, both those affecting potential future demand for health and social care in a world coping with climate change, and the potential impacts on the buildings and infrastructure required to deliver that care.

8.34 Time and resource constraints will inevitably limit what can be delivered in such an application relative to what is ultimately possible. This note sets out what is immediately desirable and achievable in terms of enhancing the Climate Risk Mapper given further investment, and points to a recommended research direction.

Data enhancements

8.35 'Notes on the data' sets out a number of data enhancements which could immediately improve the ability for decision makers to set priorities for planning. These and some others are summarised below.

8.36 **Flood data:** Environment Agency data is carefully defined and only describes fluvial and sea flood risks. These are the most significant flood risks currently forecast to affect London, which is less likely to experience major increases in seasonal precipitation than western parts of the UK. However, the densely built-up nature of the urban area means that storm flooding is likely to put additional pressure on runoff management systems, which are mostly designed to withstand only a 1 in 30 year storm event. As the GLA's 2010 Draft Climate Change Adaptation Strategy for London makes clear, their regional flood risk appraisal, EA's catchment flood management plans and local authorities' strategic flood risk assessments will all add to local knowledge of pluvial flood risk areas, and EA data on runoff flood zones is included in that draft report.

- **Recommendation:** add all available additional flood data to the Climate Risk Mapper.

8.37 **Climate data:** The coarse resolution of climate data means it will never give fine-scale insight into differential impacts. However, extreme weather events will increase as a result of climate change, and will be the most meaningful way in which most Londoners will experience the impacts of climate change. The CREW project is an example of a study which is due to output detailed findings on extreme weather based on a sample area in south London in 2011, and this may yield additional insights into risks to health and social care.

- **Recommendation**: incorporate additional data on projected extreme weather events.

8.38 **Population data:** We have access to more detailed demographic data for all London boroughs which could with additional resource provide a richer insight into the likely demand for health and social care in future, particularly in boroughs likely to experience a fast-aging population, and also those where the birth-rate is already accelerating. Factors affecting demand for care due to the impacts of climate change are discussed below, but as an immediate priority this data could be enhanced.

- **Recommendation:** break out population projections by age group to pinpoint potential highest-demand demographics.

8.39 Building density / urban heat island

- **Recommendation:** given the highly urbanised nature of London and the known health risks of heat exhaustion, it is logical to suggest including full heat island study data in the application in order to assess the risks which may result both to supply of and demand for health and social care provision.

Analysing data

8.40 Data presented on a map gives clear and immediate insight into the locations most at risk from individual climate change effects. This is powerful in itself, but given time and appropriate data, the application of geographic information science allows us to take the level of analysis and resulting insight much further.

8.41 In particular, it allows us to systematically analyse and reveal locations which are impacted by multiple factors – vital in building understanding of such a multi-dimensional set of influences. Spatial statistical methods allow us to integrate data on the physical risk of climate change and extreme weather to specific locations (i.e. potential impacts on the supply of care) with the combined effects on vulnerable populations (influences on demand for care).

8.42 **Identifying priority locations by 'triage':** Together, this could in effect allow decision makes to apply 'triage' to planned and existing health and social care locations, isolating:

- Those locations so compromised by physical risk that they should not receive investment for their future use
- Those locations which are relatively safe from climate risks which could be prioritised for investment to replace others
- Those locations which are at physical risk, but whose surrounding populations have such significant needs that they require investment in risk adaptation.

Integrating wider determinants of health

8.43 The wider determinants of health (education, housing quality, transport, access to amenities etc) can be readily integrated into a GIS-enabled model to create a single metric of health inequality. This is closely analogous to a weighted overlay application Geofutures built for the Environment Agency to determine environmental inequality based on individually user-weighted criteria.

8.44 We might characterise these as 'population at risk' factors, and use them to derive an integrated current at-risk data surface illustrating how health inequality is currently distributed across London. Integration of multiple datasets is a well-tested methodology (e.g. used by Geofutures to derive consistent UK-wide town centre statistical boundaries for CLG) and is likely to reveal locations where data on single health determinants do not highlight an issue, but where combined effects are significant.

8.45 We can then integrate the climate related and projected demographic and health risk factors to create a future risk surface series, highlighting how the interaction of all these determinants will create future areas of significant inequality and vulnerability.

Scenario modelling

8.46 A GIS-enabled tool allows expert and non-expert users to interact with the data, designing climate scenarios and also incorporating the effects of additional service stresses such as pandemics, viewing the locations most at risk under each scenario.

8.47 The third level of 'triage' set out above can hence be identified, giving comparable numeric index values to levels of combined risk at chosen locations.

Network modelling

8.48 Building further on this, there is also the opportunity to apply network modelling to key locations based on their combined risk levels, a technique which Geofutures has used e.g. for ONS in creating the spatial sampling strategy for the CPI. This allows the connectivity and

transport access of key locations to be systematically identified, helping to plan care continuity and back-up provision between at-risk locations.

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