



# Climate change and health systems in the UK – impacts, vulnerability, and monitoring

29 June 2018

Dr Sari Kovats, Senior Lecturer,  
Director, NIHR Health Protection Research Unit in Environmental Change and Health,  
Department of Social and Environmental Research, LSHTM



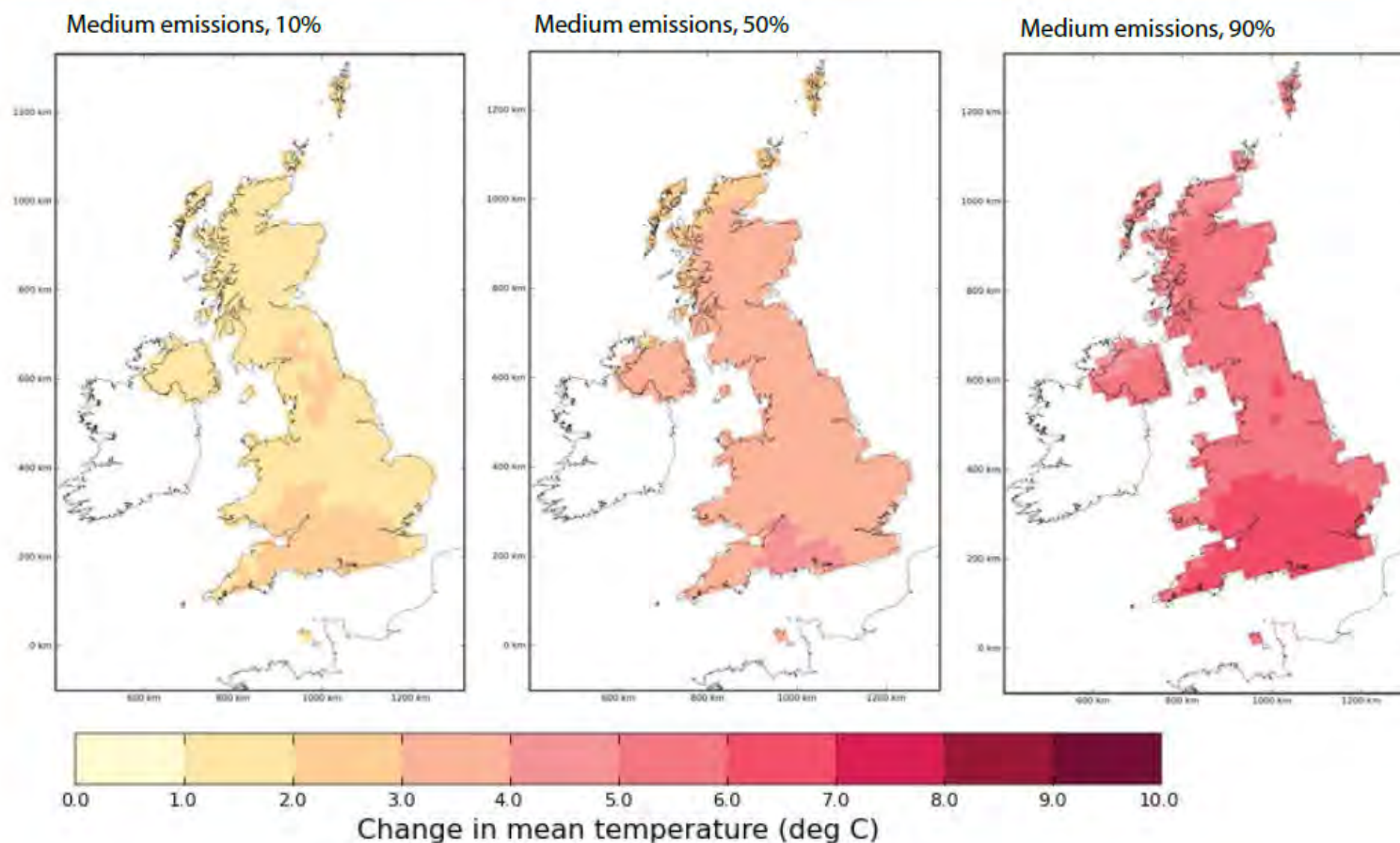
# outline

- The UK Climate Change Risk Assessment
  - Key findings for health
- Evidence of the impact of extremes on health systems
- Monitoring progress on adaptation
  - indicators

# Future projections of 30-year average summer temperature from UKCP09 in a 2-5 degree world



**Figure 5.4.** Future summer temperature projections for the UK for the 2050s



**Source:** UK climate projections 2009 (<http://ukclimateprojections.metoffice.gov.uk/21708>)

**Notes:** Maps show the range of projections in summer mean temperature for the period 2040-2069, medium emissions, from the 10% to 90% probability level.



# Projections of extreme temperature and rainfall in a 3-4 degree world



**Table 1.A1.** Values of 20-year return period events for daily maximum surface temperature in summer (June-August), and accumulated rainfall over five consecutive days in winter (December-February)

City	Daily summer max temperature (°C)				5-day winter rainfall accumulation (mm)			
	1961-1990 Observed	2041-2060 Low	2041-2060 Central	2041-2060 High	1961-1990 Observed	2041-2060 Low	2041-2060 Central	2041-2060 High
London	34.4	34.1	37.2	40.6	56.1	57.8	62.5	68.3
Cardiff	31.7	31.9	34.7	38.1	73.6	76.6	79.8	83.6
Belfast	25.9	26.5	28.5	30.9	70.3	70.6	76.9	84.6
Edinburgh	23.5	24.8	26.2	27.9	63.4	63.5	70.0	78.4

**Source:** from Brown et al. (2014).

**Notes:** For each national capital, estimated observed values for 1961-1990 are compared with values for the 10<sup>th</sup> (low), 50<sup>th</sup> (central) and 90<sup>th</sup> (high) percentiles of probabilistic projections for 2041-2060 under the A1B emissions scenario. The values represent 25x25km<sup>2</sup> spatial averages, for locations on the UKCP09 grid (Murphy et al., 2009) containing national capitals. In order to derive observational estimates, the 5km gridded station dataset of Perry et al. (2009) was interpolated to the UKCP09 grid. Projections are obtained by applying the UKCP09 methodology to predict future changes in parameters controlling the properties of statistical EVD. The examples provided show cases where the results are robust to plausible variations in the methodology, based on sensitivity tests assessing the degree of consistency between the global and regional modelling components of UKCP09.

Source: Brown, S., Murphy, J., Harris, G. and Sexton, D. (2014) Climate projections of future extreme events accounting for modelling uncertainties and historical simulation biases. *Climate Dynamics*, 43, 2681-2705.



**UK  
2017** | Climate  
Change  
Risk  
Assessment

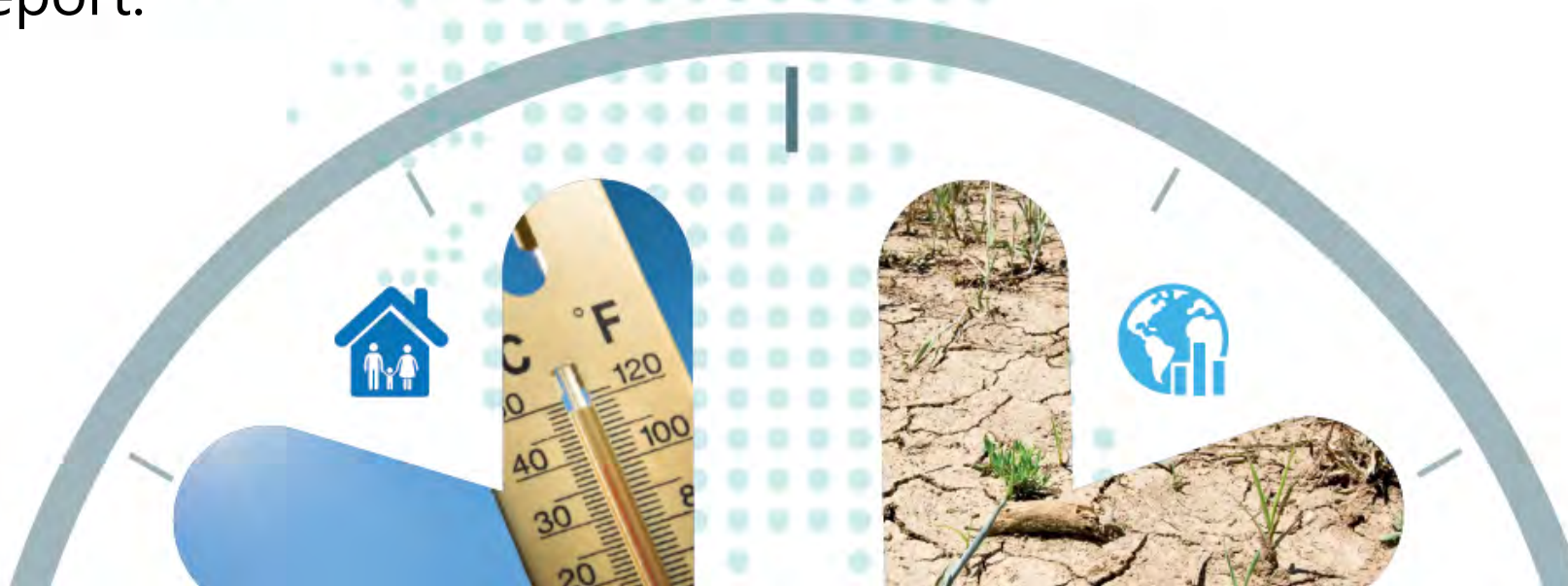
# UK Climate Change Risk Assessment 2017

@theCCCuk  
#UKClimateRisk



Evidence  
report:

priorities for the next five years





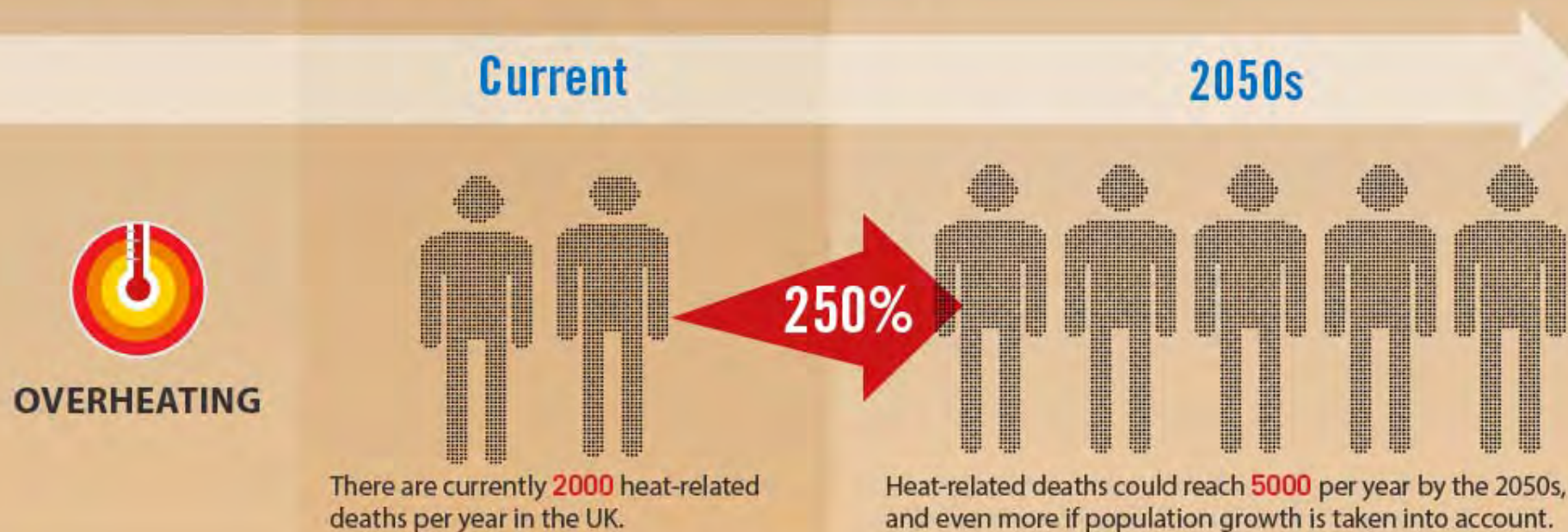
# UK Action on Climate Change

## Six priority areas





## KEY RISKS TO PEOPLE AND COMMUNITIES





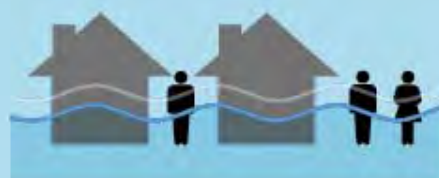
## KEY RISKS TO PEOPLE AND COMMUNITIES

Current

2050s



### FLOODING



**1.8 million** people in the UK are living in areas at significant risk of flooding.



The number of people at risk is projected to rise to **2.6 million** in a 2°C global warming scenario.





## KEY RISKS TO PEOPLE AND COMMUNITIES

Current

2050s



### PESTS AND DISEASES



People in the UK are already exposed to food and water-borne diseases such as campylobacter, and to diseases carried by some organisms, such as lyme disease.

The number of pests in the UK, such as ticks, ants and house flies, may increase due to climate change.



Existing diseases like lyme disease could increase, and new diseases could be transmitted to the UK.



## OUR WELLBEING INCLUDES...



### ADAPT TO CLIMATE CHANGE AND IMPROVE WELLBEING BY...

- Increasing urban green space
- using sustainable urban drainage (SuDS)
- making temperatures in homes comfortable in winter and summer

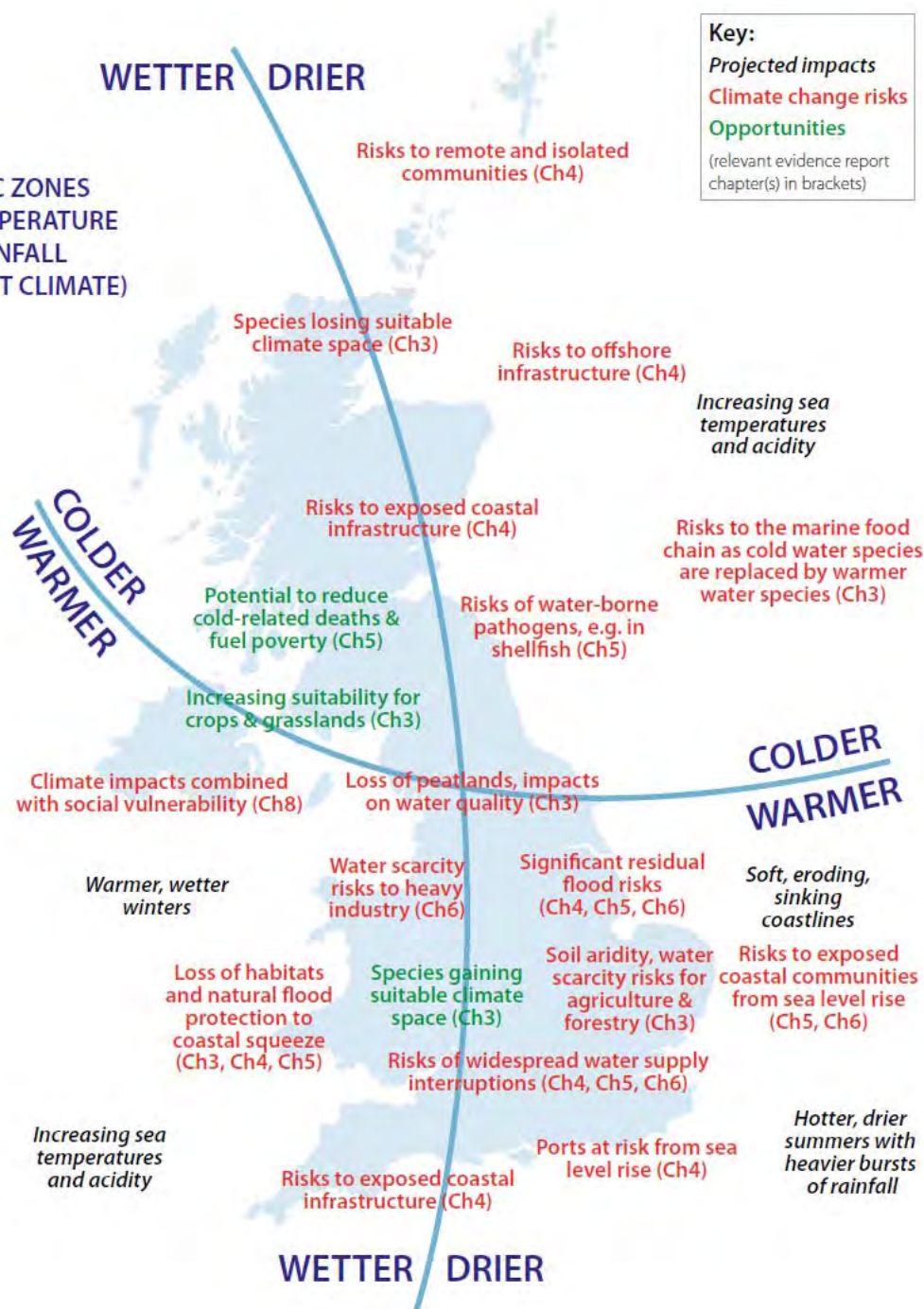


### INSTEAD OF...

- limited green space
- overloaded drainage
- overheating homes
- cold and damp homes



CLIMATIC ZONES  
FOR TEMPERATURE  
AND RAINFALL  
(CURRENT CLIMATE)



Risks vary in  
different parts of  
the UK



MORE ACTION NEEDED	RESEARCH PRIORITY	SUSTAIN CURRENT ACTION	WATCHING BRIEF
Ne1: Risks to species and habitats from changing climate space	Ne3: Changes in suitability of land for agriculture & forests	Ne9: Risks to agriculture, forestry, landscapes & wildlife from pests/pathogens/invasive species	Ne14: Risks & opportunities from changes in landscape character
Ne2: Opportunities from new species colonisations	Ne7: Risks to freshwater species from high water temperatures	Ne10: Extreme weather/wildfire risks to farming, forestry, wildlife & heritage	In7: Low/high riverflow risks to hydroelectric generation
Ne4: Risks to soils from increased seasonal aridity and wetness	Ne13: Ocean acidification & higher water temperature risks for marine species, fisheries and marine heritage	Ne11: Saltwater intrusion risks to aquifers, farmland & habitats	In8: Subsidence risks to buried/surface infrastructure
Ne5: Risks to natural carbon stores & carbon sequestration	In5: Risks to bridges and pipelines from high river flows/erosion	In13: Extreme heat risks to rail, road, ICT and energy infrastructure	In10: Risks to electricity generation from drought and low flows
Ne6: Risks to agriculture & wildlife from water scarcity & flooding	In11: Risks to energy, transport & ICT from high winds & lightning	In14: Benefits for infrastructure from reduced extreme cold events	PB3: Opportunities for increased outdoor activity in warmer weather
Ne8: Risks of land management practices exacerbating flood risk	In12: Risks to offshore infrastructure from storms and high waves	PB13: Risks to health from poor water quality	PB12: Risks of food-borne disease cases and outbreaks
Ne12: Risks to habitats & heritage in the coastal zone from sea level rise; loss of natural flood protection	PB2: Risks to passengers from high temperatures on public transport	PB14: Risk of household water supply interruptions	Bu4: Risks to business from reduced access to capital
In1: Risks of cascading infrastructure failures across interdependent networks	PB6: Risks to viability of coastal communities from sea level rise	Bu3: Risks to business operations from water scarcity	Bu7: Business risks /opportunities from changing demand for goods & services
In2: Risks to infrastructure from river, surface/groundwater flooding	PB7: Risks to building fabric from moisture, wind, and driving rain	Bu6: Risks to business from disruption to supply chains	It7: Opportunities from changes in international trade routes
In3: Risks to infrastructure from coastal flooding & erosion	PB8: Risks to culturally valued structures and historic environment		
In4: Risks of sewer flooding due to heavy rainfall	PB10: Risks to health from changes in air quality		
In6: Risks to transport networks from embankment failure	PB11: Risks to health from vector-borne pathogens		
In9: Risks to public water supplies from drought and low river flows	Bu2: Risks to business from loss of coastal locations & infrastructure		
PB1: Risks to public health and wellbeing from high temperatures	Bu5: Employee productivity impacts in heatwaves and from severe weather infrastructure disruption		
PB4: Potential benefits to health & wellbeing from reduced cold	It2: Imported food safety risks		
PB5: Risks to people, communities & buildings from flooding	It3: Long-term changes in global food production		
PB9: Risks to health and social care delivery from extreme weather	It5: Risks to the UK from international violent conflict		
Bu1: Risks to business sites from flooding	It6: Risks to international law and governance		
It1: Weather-related shocks to global food production and trade			
It4: Risks from climate-related international human displacement			

Resulting risks and opportunities are classed by urgency category, based on the evidence provided

KEY TO CHAPTERS:

Chapter 3: Natural environment and natural assets

Chapter 4: Infrastructure

Chapter 5: People and the built environment

Chapter 6: Business and Industry

Chapter 7: International dimensions

# Evidence...

	Communities and settlements	Buildings	Health and social care system	Population health
Heatwaves	Heatwaves, urban heat island, air pollution	Overheating	Overheating risks to patients, social care, occupational risks, energy use	Heatwave risks to population, mortality, injury etc.
Floods	Flooded communities, resilience, relocation, blight/ economic effects	Flood damage, damp, mould	Flood risks to NHS assets, service disruption	Flood impact on mental health, deaths and injuries
Drought	Risk to water supply, drought	Subsidence	Service disruption	Water supply failure, risks to public health
Cold	Risks from extreme weather	Damp homes, cold homes	Service disruption	Cold risks to mortality and morbidity





# Heatwave impacts

- Discomfort or distress of patients, and their visitors
- Equipment failure, such as failure of essential refrigeration systems
- Disruption of IT services
- Disruption of laboratory services
- Discomfort of staff (occupational health)
- Degradation or loss of medicines.



[WHO, 2009](#), [Carmichael et al., 2013](#)).





## Care Homes/Nursing homes

- Qualitative study(Gupta et al. 2016)
- Buildings - risk of summertime overheating, especially during short-term heat waves (2-4 days) with indoor temperatures rising to nearly 30°C in communal areas and resident rooms.
- Non-structural factors that affected overheating risk include
  - fixed daily routines of care home residents making it difficult to accommodate periods of intense heat;
  - management structures and systems which do not always allow for staff to alter temperatures;
  - a culture which focuses on cold as the main climate risk

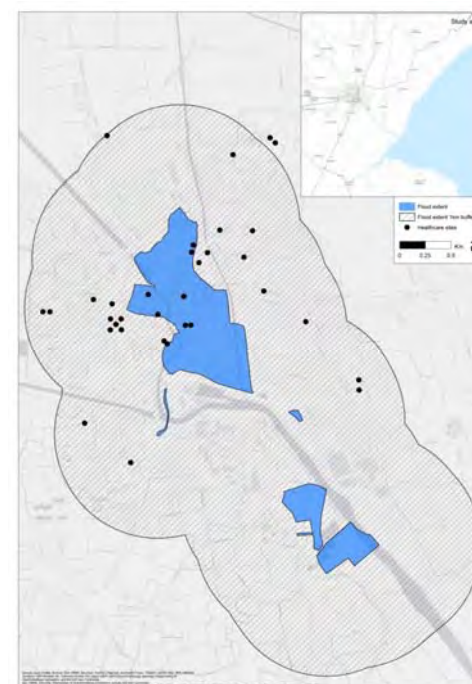




## Flood impacts

- Disruption by staff shortages
- Infrastructure damage needs coordination across services
  - Mutual needed to transfer patients
- Difficulty identify at risk populations
  - Palliative care patients, complex/bariatric patients, language issues (migrant labour).

## Boston flood




**Table 4.3.** Overview of key climate risks for each infrastructure sector

Hazard Sector	Floods	Water scarcity	High temperatures	(Wind) Storms	Geohazards (inc. subsidence and landslides)
Water and waste water	✓✓	✓✓	✓		✓
Transport	✓✓		✓	✓✓	✓✓
Energy generation	✓✓	✓	✓	✓	
Energy distribution	✓✓		✓	✓✓	✓
Flood and coastal defences	✓✓			✓	✓
Solid waste	✓		✓		
ICT	✓✓		✓	✓✓	✓

**Source:** Expert judgement arising from the literature reviewed in this chapter.

**Notes:** A single tick denotes a relationship; a double tick denotes a strong relationship. These do not consider dependencies between infrastructures.





# Key points

- Floods, storms, snow and heatwaves already affect health system infrastructure and service delivery through effects on staff, buildings and equipment.
- **Heatwaves** affect the functionality of hospitals and care homes. Health services will be vulnerable to an increase in the frequency and intensity of heatwaves.
- **Flood** risks to NHS and social care assets are likely to increase under climate change. Future projections indicate an increase in the number of GP surgeries, care homes, emergency service stations and hospitals in the flood risk zone, with the largest change in risk generally shown for care homes. England and Wales show bigger increases in risk than Scotland and Northern Ireland.
- Cold spells and snow storms interrupt travel for patients and staff. Fewer cold events in future will benefit health system management.
- The capacity of the health and social care system to manage climate risks is unknown.
- Overall capacity could also decrease due to **fragmentation** of services which increases the complexity of risk management.



# Adaptation options for dealing with climate risks

Climate change	Climate risk	Adaptation option
Higher temperatures	Hot weather, heatwaves	Managing UHI and outdoor temperature through planning, urban and building design and construction options
		Housing – building fabric, insulation and ventilation trade-off
		Heat health warning systems – public health responses
		Emergency planning
Increased intensification of rainfall	Flooding, coastal erosion and/or inundation	Reducing development in flood risk areas through planning, settlement design options
Sea-level rise		Property-level protection measures
Storms		Flood defence (sea walls, etc.) and natural flood management
Storm surges		Increasing resilience in communities (e.g. governance, connectedness and cohesion)
		Emergency planning



# Limits to adaptation (current)

- Limited incorporation of the full scope of planning policy and its means of implementation in local planning processes and construction practices in new developments .
- Fragmentation of services. For example in health and social care sectors
- Gaps in building and construction codes
- Lack of appropriate governance (e.g. co-ordination or integration of efforts between and within national and local authorities; limited links to local communities)
- Lack of knowledge and research to provide greater granularity in flood risk and damage estimates
- Poor housing quality and lack of or inappropriate retrofitting
- Lack of co-ordination with other policies (e.g. energy efficiency in housing, invasive species policies that only focus on biodiversity).
- Low public perceptions of risk (heatwaves and floods).





# Monitoring is difficult

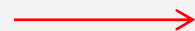
- Process indicators
  - Adaptation Plans
  - Emergency Plans
- Exposure indicators
  - Flood events
  - Flooded care homes/hospitals
- Outcome indicators
  - ?Flood impacts?
  - ?Heat impacts

# Monitoring & Reporting Framework for local authorities within the Covenant of Mayors Initiative

Impacted Policy Sector	Expected Impact(s)
<u><b>Buildings</b></u>	Increased need for cooling, risk for flooding, increased need for maintenance
<u><b>Transport</b></u>	risk for flooded roads
<u><b>Energy</b></u>	Increased risk for damage to electric grid outside Växjö, due to storms
<u><b>Water</b></u>	More systems are needed to take care of storm water, risk for drought, risk for pollution of water
<u><b>Land Use Planning</b></u>	Increased risk for urban heating, flooding of buildings close to lakes and streams, flooding due to heavy rainfall
<u><b>Agriculture &amp; Forestry</b></u>	increased attacks from insects and diseases, damages due to storms, floods
<u><b>Environment &amp; Biodiversity</b></u>	changed ecosystems
<u><b>Health</b></u>	increased risks for diseases, risk for mortality due to increased heat

Climate Hazard Type		Risk Level	Expected change in intensity	Expected change in frequency	Timeframe
Extreme Heat		!!	↑	↑	▶▶
Extreme Precipitation		!!!	↑	↑	▶▶▶
Floods		!!	↑	↑	▶▶
Sea Level Rise					
Sector	Title (max. 120 chars)	Short description (max. 300 chars)	Responsible body/department		
Health	Action plan for normal inside temperature	Priority level 1. An action plan is needed to make sure that indoor climate is acceptable in schools, hospitals etc during extreme outside temperatures	Educational Services, Elderly and Disabled Care Services, Municipal Housing and Property Companies		
Health	Inform the public about health effects due to heat waves	Priority level 2.	Educational Services, Elderly and Disabled Care Services, Executive Office		
Health	Educate key staff about health effects due to climate change	Priority level 2. Information and education directed towards staff and management within the departments of schools and elderly care.	Educational Services, Elderly and Disabled Care Services		

Health



Refers to the geographical distribution of dominance of pathologies (allergies, cancers, respiratory and heart diseases, etc.), information indicating the effect on health (biomarkers, decline of fertility, epidemics) or well-being of humans (fatigue, stress, post-traumatic stress disorder, death etc.) linked directly (air pollution, heat waves, droughts,



# Findings:

## EU review of adaptation

- New international agreements (Paris, Sendai, SDGs) created new need for alignment
- Need to implement the adopted National Adaptation Strategies (NAS)
- Reinforced need for sub-national action
- New knowledge about high-end climate change creates more need of sectoral climate proofing and disaster risk reduction
- Further need to involve business and insurers to ensure investments





# Current evidence on evaluation of Heat Action Plans

- Outcome evaluation. Limited evidence for effectiveness of the system as a whole
  - Non-specific, before and after comparison
  - No information on implementation.
  - Effectiveness may be limited under very high temperatures
- Process evaluation of implementation
  - Difficulty reaching front line staff
  - Care home managers.
- Process evaluation of general public
  - general public, knowledge and perceptions.
  - Difficult to access the perceptions of those most at risk





# Conclusions

- Extreme weather effects health and social care delivery
- Adaptation measures are in place- emergency planning
- But it is difficult to assess the level of preparedness/resilience,
  - especially at regional/national level
- Concern about complex events
- Evidence gaps for specific measures
  - Occupational risks
  - Drug management