REVIEW OF HEALTH IMPACTS

Task 2.1.1

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CC health effects – current scope

Health outcome	Known effects of weather and climate variability
Heat stress	• Heat waves increase the risk of deaths and hospitalisations in the elderly. • High temperatures increase the risk of occupational and leisure-related heat injuries and heat stroke
Cold	• Low temperatures increase the risk of death from cardio-respiratory disease, and hypothermia and cold-injuries amongst the exposed (e.g. occupational, homeless)...
Air pollution-related mortality / morbidity	• Weather affects air pollutant concentrations, and seasonality and production of aeroallergens. Hot, dry weather increases risk of wild fires and thus smoke exposure.
Health impacts of floods and windstorms	• Events have direct effects (deaths and injuries) and indirect effects (e.g. long-term psychological morbidity), and may damage critical infrastructure (e.g. health services, water supply systems).
Mosquito-borne diseases, tick-borne diseases	• High temperatures increase rate of vector development and biting habits. • Climatic condition affect vector viability directly and via impacts on habitat and other species (e.g. hosts, predators).
Food-borne diseases	• Temperature affects survival for some pathogens (Salmonella) but not others (rotavirus).
Water-related diseases	• Drought may affect water availability and quality. Heavy rainfall may results in infectious disease outbreaks (e.g. floods in urban areas are sometimes associated with leptospirosis).

Kovats, S, Lloyd, S, Hunt, A and Watkiss, P. (2011)

heat and mortality

- pooled MA functions
- % increase in all mortality for each degree AT above threshold
  - based on PHEWE study of 15 cities in Europe (Baccini et al. 2008)
- adaptation – limited evidence
  - reduction on heat-related hospital admissions with use of central air conditioning = 0.51 [0.02, 1.0] (Ostro et al, 2010)
  - effects of acclimatisation (autonomous adaptation)

Age, yrs.	Mediterranean	North-Continental
	% change (95% CI)	% change (95% CI)
All	3.12 (0.60; 5.73)	1.84 (0.06; 3.64)
15–64	0.92 (-1.29; 3.13)	1.31 (-0.94; 3.72)
65–74	2.13 (-0.42; 4.74)	1.65 (-0.51; 3.87)
75+	4.22 (1.33; 7.20)	2.07 (0.24; 3.89)

Source: Baccini et al. 2008

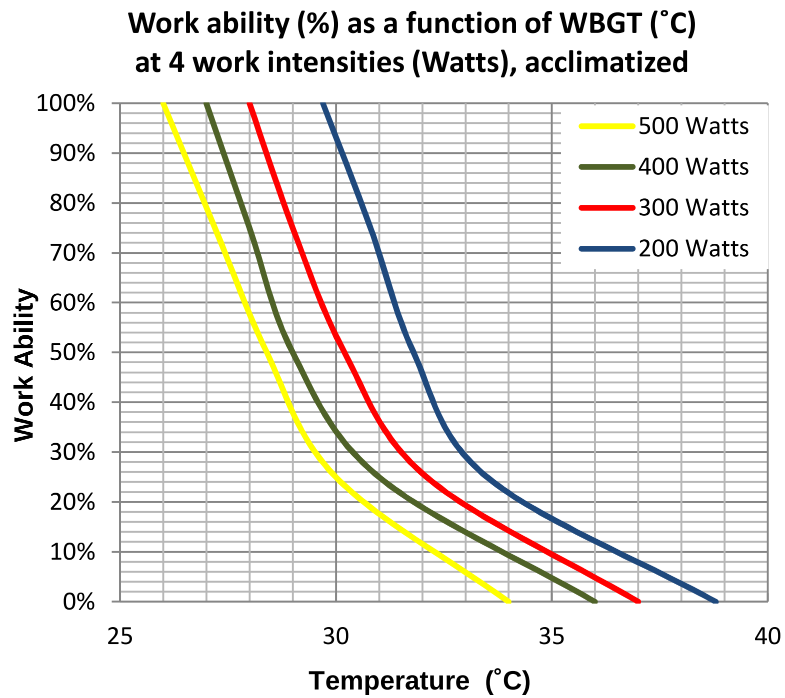
heat and morbidity

- morbidity impacts of temperature not as consistent or extensively characterised as mortality outcomes, especially in relation to hot weather (Kovats and Hajat, 2008)
- emerging evidence_
  - potential impact of hot weather on hospital admissions due to cardiovascular and respiratory diseases (Lin et al., 2009)
  - association between temperature and hospital admissions (Ostro et al., 2010)
  - association between heat and humidity (apparent temperature) and preterm delivery (Basu et al., 2010)

occupational heat stress

- Effects
  - Mild
  - Moderate
  - Severe – heatstroke, death

- Responses
  - self-pacing → reduced output (and/or occupational health interventions)



Source: Kjellstrom et al., 2008

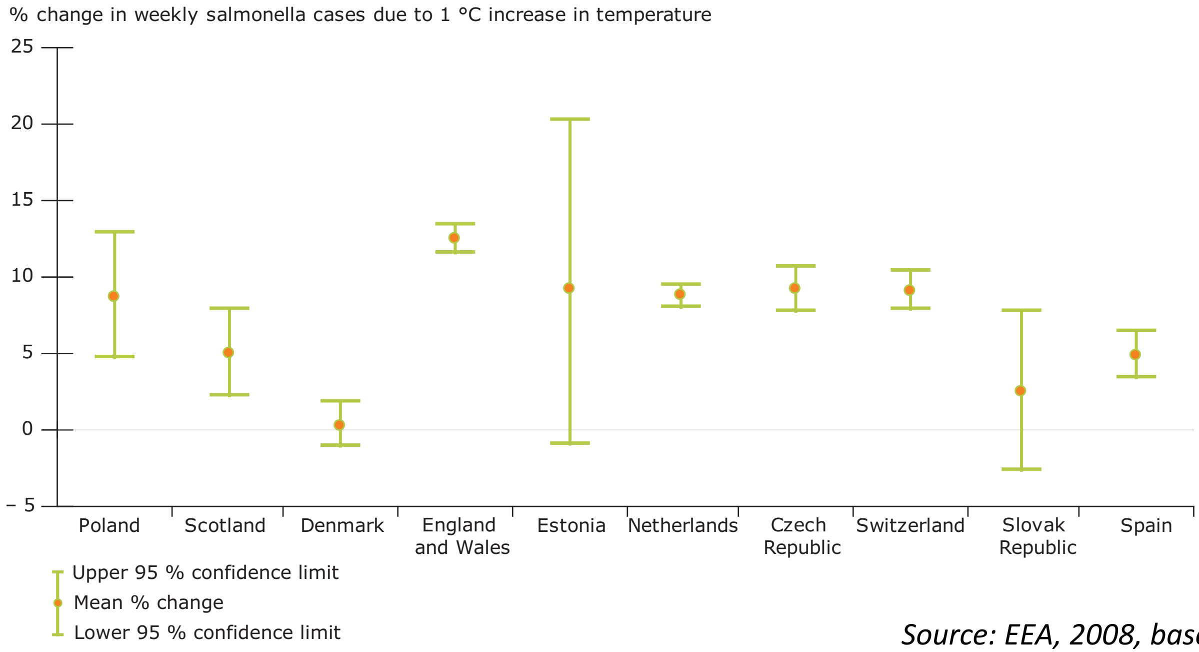
flooding and mortality

- over the last 10 years, floods in Europe have killed more than 1,000 people and affected over 3.4 million others
- top 10 flood disasters in the EU27 from 2000–2009 according to total number affected

Year	Country	Start month	Number killed	Total number affected	Total damages (,000 US$)
2007	United Kingdom	July	7	340,000	4,000,000
2002	Germany	August	27	330,108	11,600,000
2002	Czech Rep	August	18	200,000	2,400,000
2000	Romania	April	9	60,431	100
2002	Austria	August	9	60,000	2,400,000
2006	Hungary	March	0	32,000	No data
2005	Romania	September	10	30,800	No data
2007	United Kingdom	June	6	30,000	4,000,000
2006	Romania	March	6	17,071	No data
2005	Romania	July	24	14,669	800

Source: Guha-Sapir et al. 2011

heat effects on food poisoning



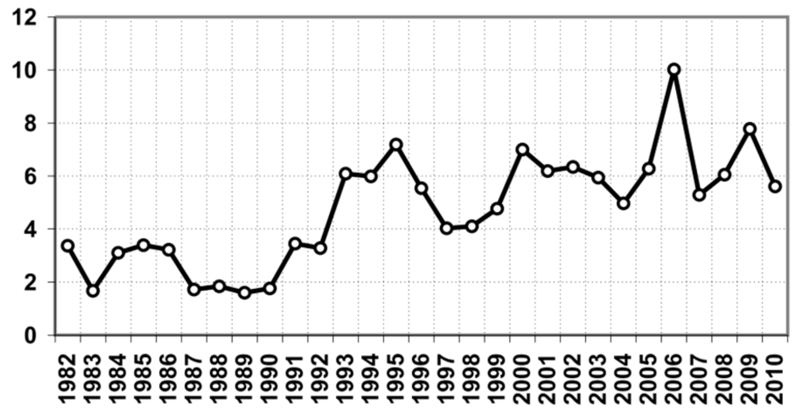
Source: EEA, 2008, based on Kovats et al., 2004

- Kovats et al. (2008) produced pooled estimate of **7.02%** (95% CI 4.50, 9.55) increase per °C above 6 °C threshold

vector-borne transmissible diseases

- increase spread of serious vector-borne transmissible diseases
- spread of ticks to higher latitudes and altitudes (Lindgren and Jaenson, 2006, Danielová et al. 2008, Lukan et al. 2010)

Reported cases of tick-borne meningocephalitis, Czech Rep., 1980-2010 (cases per 100,000 inhabitants)



Sorce: Kříž and Beneš (2011)

health valuation | components

market goods

- changes in demand for medical treatment
- change in labour productivity (work incapacity)

non-market goods

- disutility due to illness and mortality risks (morbidity, mortality)

income change

- loss in productivity and earnings in future (e.g. IQ decrement)

Valuation of Premature Mortality

- effects on mortality risk ideally characterised as shifts in individual (population) survival curves
- Mortality risk can be measured in terms of_
  - lives saved (prevented fatality) → VSL
    - ➢ accidents, (job-related) fatalities, respiratory, cardiovascular, cancers
  - life extension (increased remaining LE) → VOLY (VSLY)
    - ➢ air quality context

- Alternatives (*though not quite consistent with welfare economics*)
  - Quality-/ Disability-Adjusted Life Years
    - ➢ costs per QALY (CEA), DALYs * VOLY etc.
  - Human capital approach
    - ➢ VSL depends on discount rate, time (lower for children), and productivity (lower for female, zero for unemployed or disabled)

Value of a Statistical Life - VSL

- Marginal value of reducing the risk of dying, defined as marginal value that the individual is willing to trade for her income

$$VSL = \left. \frac{\partial WTP}{\partial R} \right|_{U=const.}$$

- WTP [500 Euro] for the risk reduction [1:1000], then VSL equals to 0.5 million Euro (500Euro * 1000)
- Reduce the risk by 1:1000 for each person in a population of 1000 people is the same as to ‘safe’ 1 life

mortality valuation

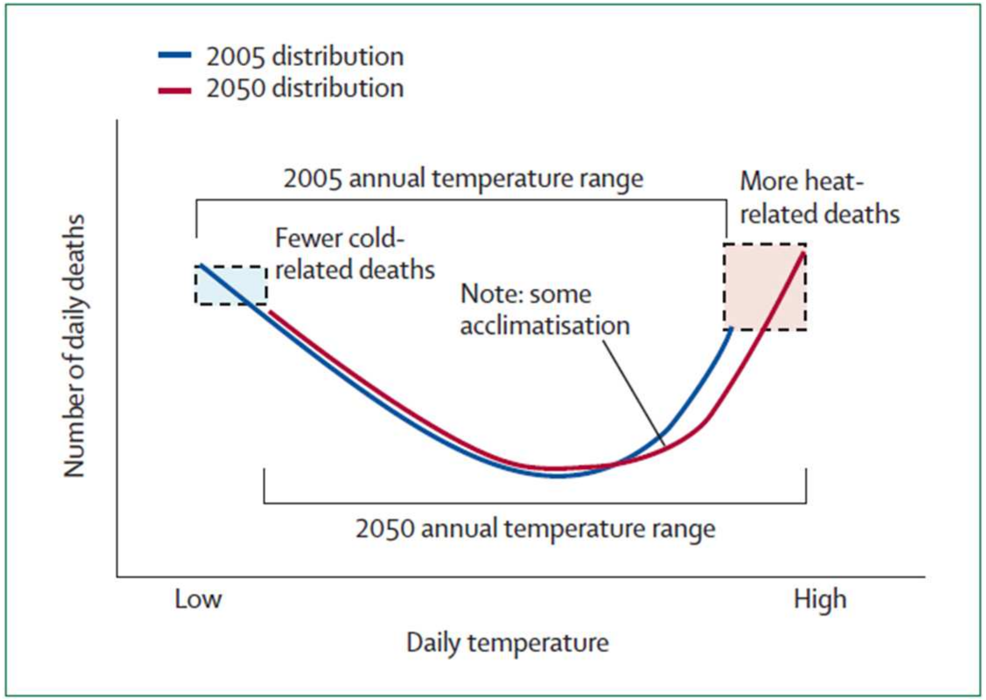
(recurrent) issues:

- lives ‘saved’ v. prevented ‘fatality‘
- **beneficiary of policy**: elderly, children, at risk (ill, exposed,…)
- **immediate** effect, latent or with a cessation leg
- **context** (environmental, occupational, accidental) --- controllability, voluntariness, risk factors, etc.
- **cause** of death (respiratory and cardiovascular diseases, cancer; malnutrition, diarrhoea, malaria)

VSL or VOLY?

- VSL/VPF used for flood related deaths (aka accidental death)
- VOLY use advocated in the case of heat mortality
  - high proportion of heat-attributable deaths are brought forward in the elderly (i.e. short term mortality displacement)
  - currently no evidence on the average YOLLs from heat related mortality

Schematic representation of how an increase in average annual temperature would affect annual total of temperature-related deaths



Source: McMichael et al., 2006

OECD indicative best VSL estimate

OECD meta-analysis by Lindhem-Navrud-Braathen (2012), recommendations:

– average adult VSL for OECD countries of USD_{2005} 1.5 – 4.5 million, with a base value of USD 3 million.

– for EU-27, the corresponding range is USD_{2005} 1.8 – 5.4 million, with a base value of USD 3.6 million

– no adjustments for age, health status, timing of risk, risk perception, cancer or dread, magnitude of risk change, public vs. private risk change

mortality: COI, productivity loss, dis-welfare

Cost-Of-Illness

– human capital approach → i.e. discounted flow of future earnings or consumption

i] Direct (resource) costs

– medical costs paid by the health service (or covered by insurance), and any other personal out-of-pocket expenses

ii] Indirect (opportunity) costs

– the cost in terms of lost productivity (work time loss, performing at less than full capacity) and the opportunity cost of leisure

– cost of absenteeism, friction costs, often approximated by GDP loss due to sickness leave

Discomfort

– WTP for dis-utility for pain and suffering

air pollution-related morbidity

morbidity outcomes in ExternE

endpoint	resource costs	productivity loss	discomfort
chronic bronchitis			x
respiratory hospital admission	x	x	x
cardiac hospital admission	x	x	x
consultation with primary care physicians: Asthma	x		x
consultation with primary care physicians: Upper respiratory disease	x		x
consultation with primary care physicians for allergic rhinitis	x		x
restricted activity day		x	x
minor restricted activity day			x
acute respiratory symptoms in children			x
lower respiratory symptom			x
medication/bronchodilator use by asthmatics	x		
cough days			x
work loss day		x	

other morbidity outcomes

Salmonellosis

- Watkiss & Hunt (2011) estimate total costs (treatment, productivity loss, discomfort) weighted by the severity incidence at between €3,500 and €7,000

Diarrhoea

- FUND model (R. Tol) uses € 16,000 for a non-fatal case (origin?)

loss of labour productivity

- Work Loss Day endpoint in ExternE (GDP per labour force member)

wider effects of flood events affecting wellbeing

- mental health, stress and depression
- WTP for depression treatment $270/month (Unützer et al., 2003)


I THINK IT'S STRESS!!