

Heat and Health

Understanding risks and predicting outcomes

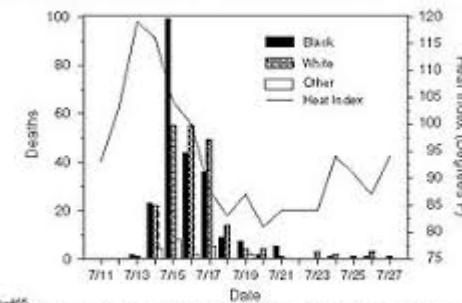
Dr Sari Kovats, Associate Professor,
Director, NIHR Health Protection Research Unit in Environmental Change and Health,
London School of Hygiene and Tropical Medicine, UK

Heat kills!

- Heat stroke
- Heat injury
- Heat related mortality
 - Deaths from other causes that can be attributed to heat
- Health events
 - Stroke, heart attack
 - Emergency hospital admissions
- Wellbeing
 - Cognition
 - Thermal comfort



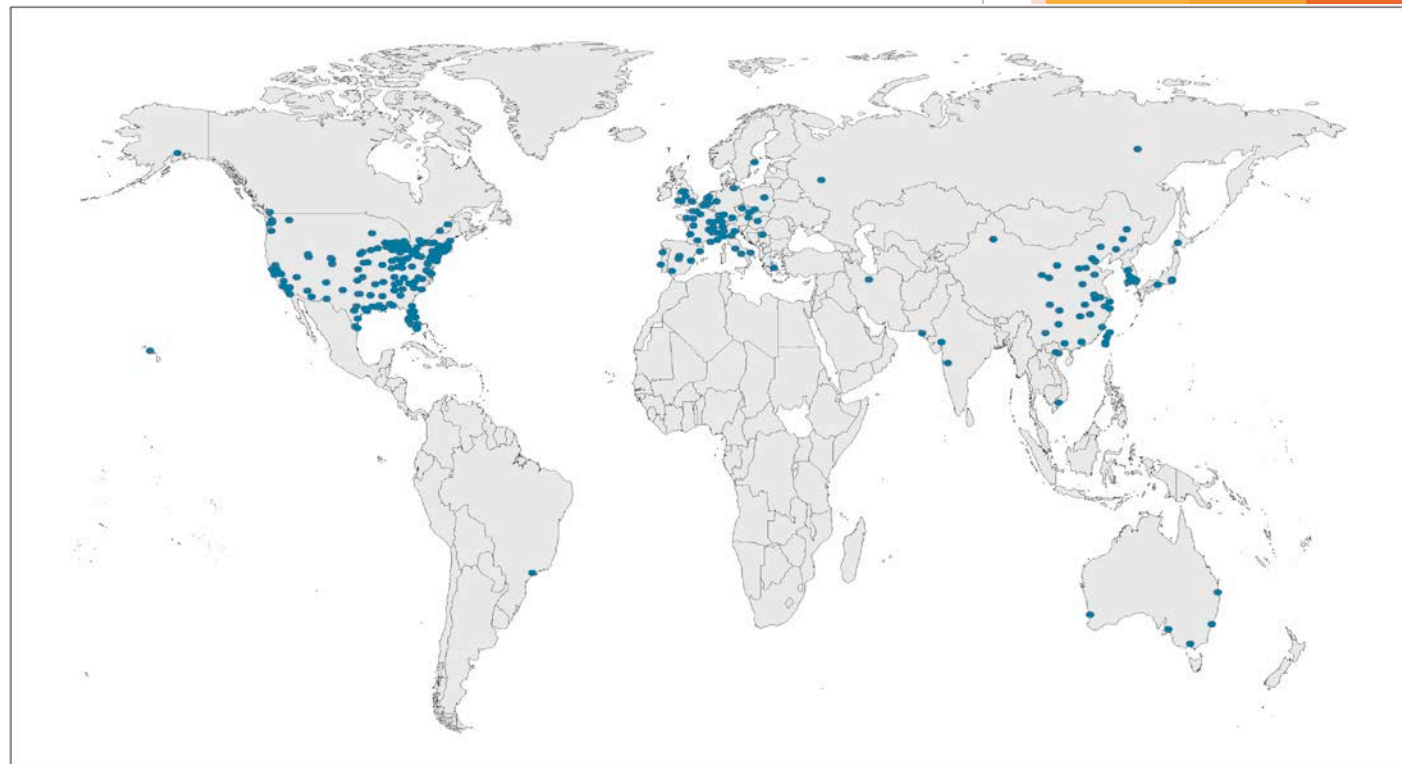
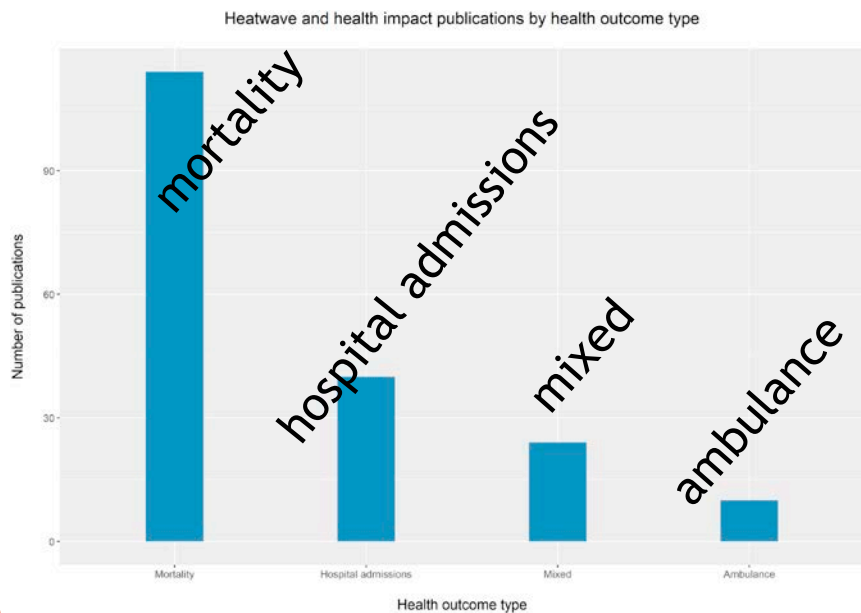
FIGURE 1. Number of heat-related deaths,* by date of occurrence and race† of decedent, and heat index, by date — Chicago, July 11–27, 1995



*n=465.
 †The Cook County Medical Examiner's Office categorizes race of decedents as black, white, or other.

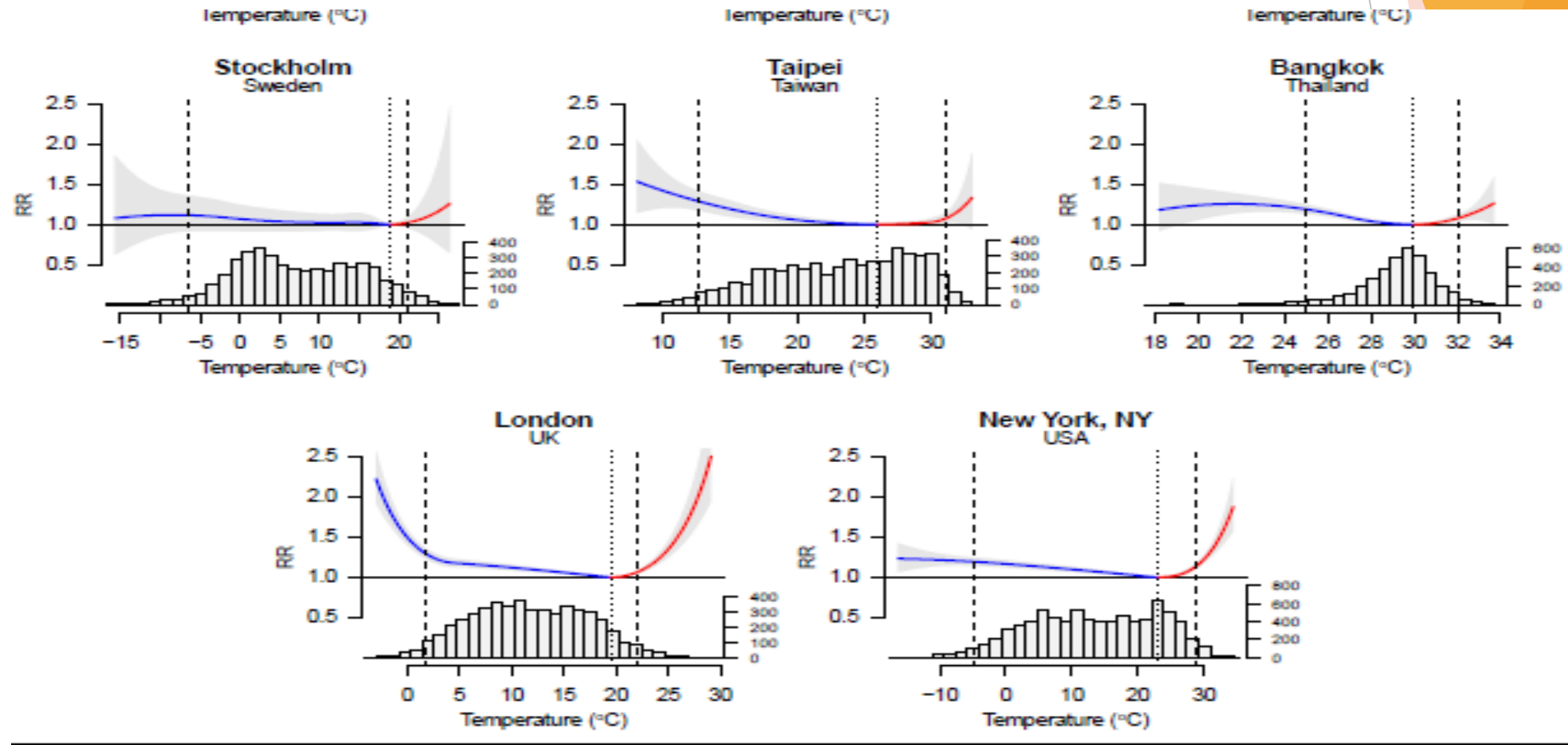
Global review of heat impact research

- ▶ Campbell et al. 2018. Health and Place, 53:210-218
- ▶ N = 188 papers

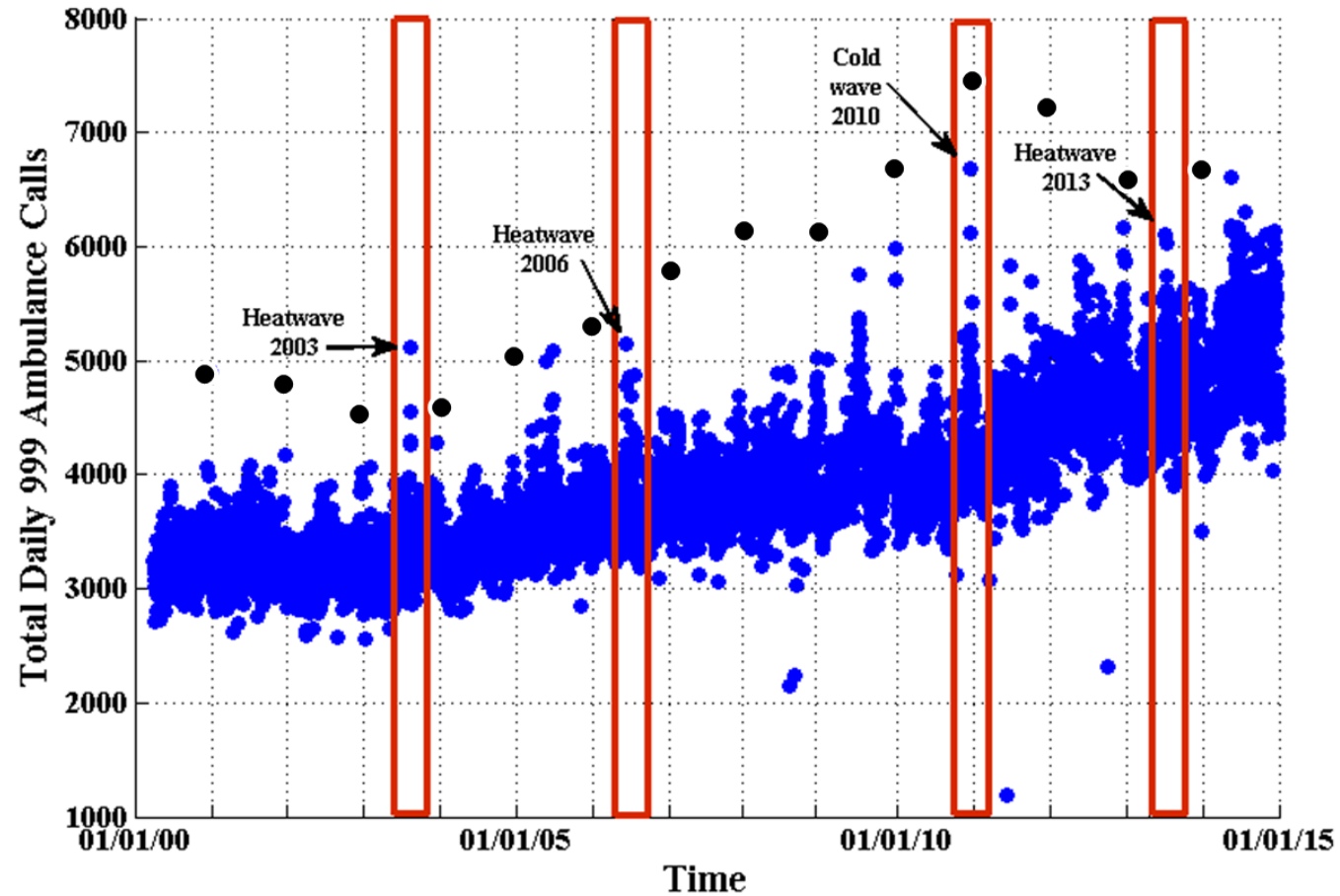


temperature-mortality functions

Gasparri et al. Lancet 2015



Ambulance calls (daily), Birmingham



High risk groups

Epidemiology/Population studies

- ▶ Limited by routine data
 - ▶ Elderly [age]
- ▶ Persons with chronic disease
- ▶ Income/deprivation



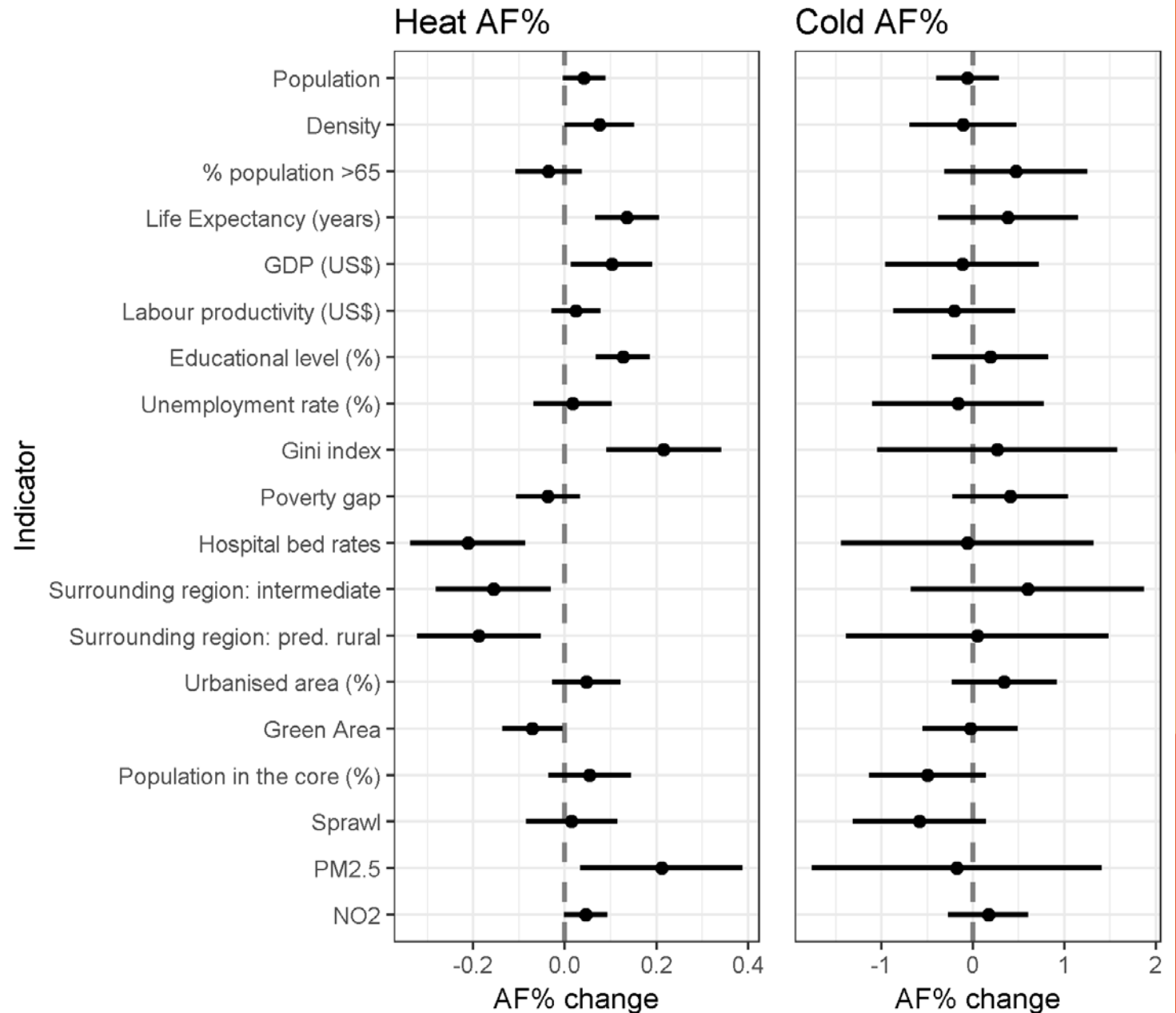
Physiology

- ▶ Age
- ▶ Mostly done on healthy adults

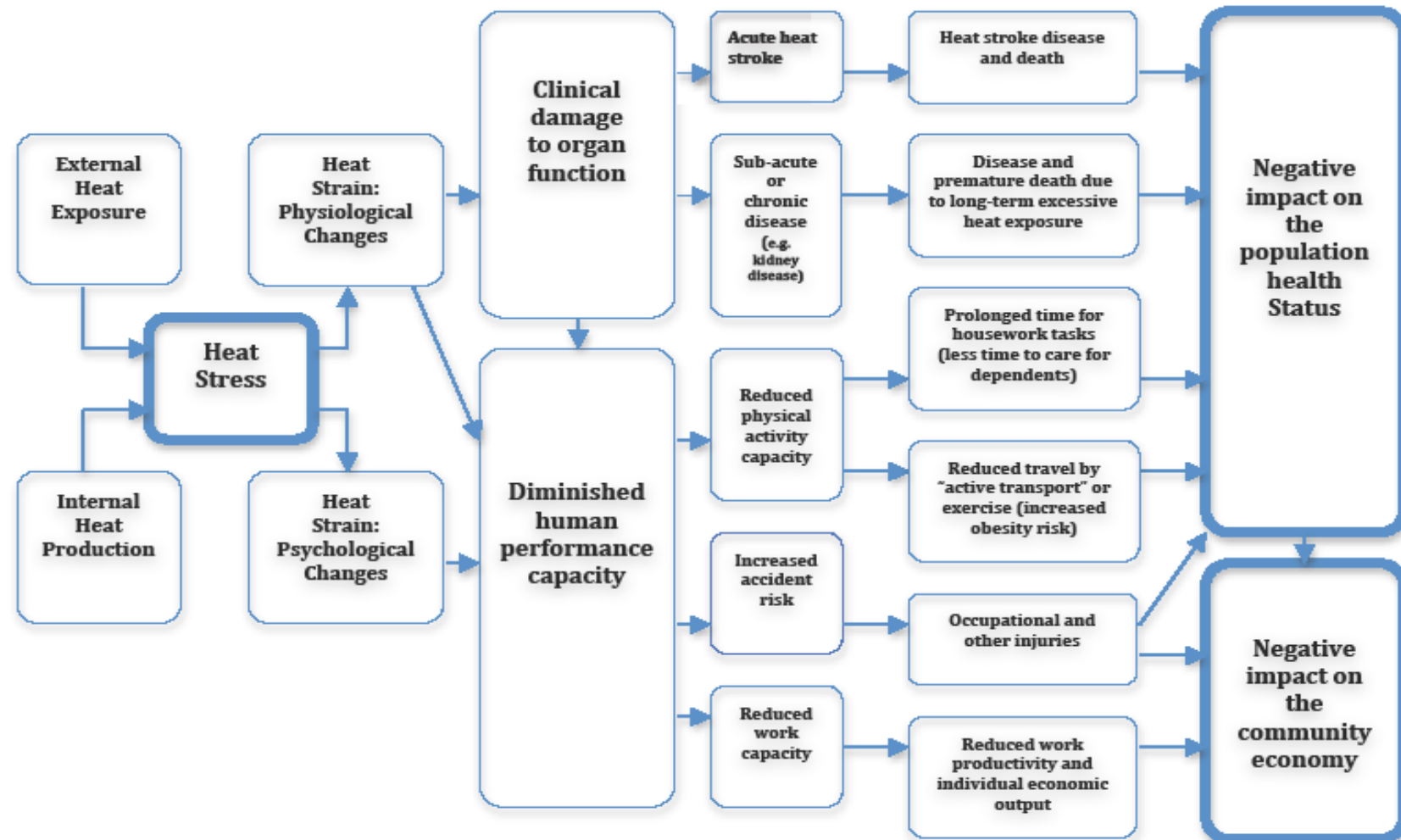


How urban characteristics affect vulnerability to heat: a multi-country analysis

- ▶ Associations between the city-level indicators and heat AF%.
- ▶ coefficients and 95%CI calculated from a meta-regression model adjusted by country and weather variables.
- ▶ Results are expressed as AF% change for SD increase of the indicator
- ▶ 340 cities
- ▶ AF% is the attributable fraction of total mortality (daily deaths)
- ▶ Sera F et al. (in press). International Journal of Epidemiology.



Health and social effects of heat stress



Source: Tord Kjellstrom.

US Occupational deaths by industry

Deaths in one of the 24 US states between 1999, 2003- 2004, 2007-2013

- ▶ Source: NIOSH (2018). National Occupational Mortality Surveillance (NOMS). U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Division of Surveillance, Hazard Evaluation and Field Studies, Surveillance Branch. Date accessed 11 December 2018

Sex	Race	Age Group	Industry	PMR	Deaths	Significance level	Lower 95% CI	Upper 95% CI
M	W	65-90	AGRICULTURE, FORESTRY, & FISHERIES [0]017-029, 748, 777, [9]010-032	238	16	p<0.01	136	386
M	B	18-64	ADMINISTRATIVE SUPPORT, WASTE MANAGEMENT [0]757-779, [9]722, 731-741, 020, 432, 471	258	8	p<0.05	111	509
M	W	65-90	AGRICULTURAL PRODUCTION, LIVESTOCK [0]018, [9]011	269	5		87	628
F	B	65-90	PERSONAL SERVICES [0]866-867, 889, 897-899, 907-909, 928, [9]761-791	302	5		98	705
M	W	65-90	MACHINERY, EXCEPT ELECTRICAL [0]307-336, [9]310-332	318	6	p<0.05	117	693
M	W	18-64	AGRICULTURE, FORESTRY, & FISHERIES [0]017-029, 748, 777, [9]010-032	348	38	p<0.01	246	478
M	W	18-64	ALL AGRICULTURE [0]017, 018, 029, 748, 777, [9]010, 011, 012, 020, 030	382	37	p<0.01	269	526
M	B	18-64	AGRICULTURE, FORESTRY, & FISHERIES [0]017-029, 748, 777, [9]010-032	420	6	p<0.01	154	915
M	B	18-64	ALL AGRICULTURE [0]017, 018, 029, 748, 777, [9]010, 011, 012, 020, 030	459	6	p<0.01	168	999
M	B	18-64	LANDSCAPE & HORTICULTURAL SERVICES [0]777, [9]020	619	5	p<0.01	201	1444
M	W	18-64	AGRICULTURAL PRODUCTION, CROPS [0]017, [9]010	744	26	p<0.01	486	1091

CKDu in Central America

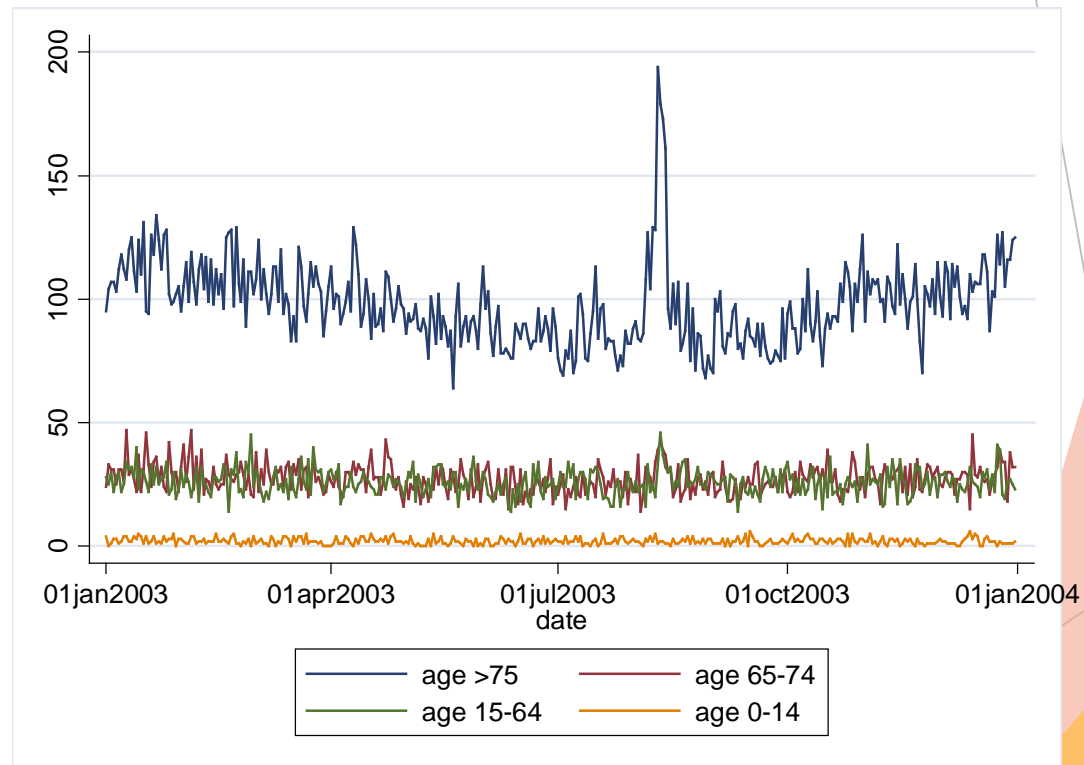
- ▶ A dramatic increase of chronic kidney disease of unknown origin (CKDu)
 - ▶ Unexplained by conventional risk factors such as hypertension and diabetes
- ▶ Primarily affecting adult male agricultural workers, in particular sugarcane workers



Along the Pacific coast, in the lowlands

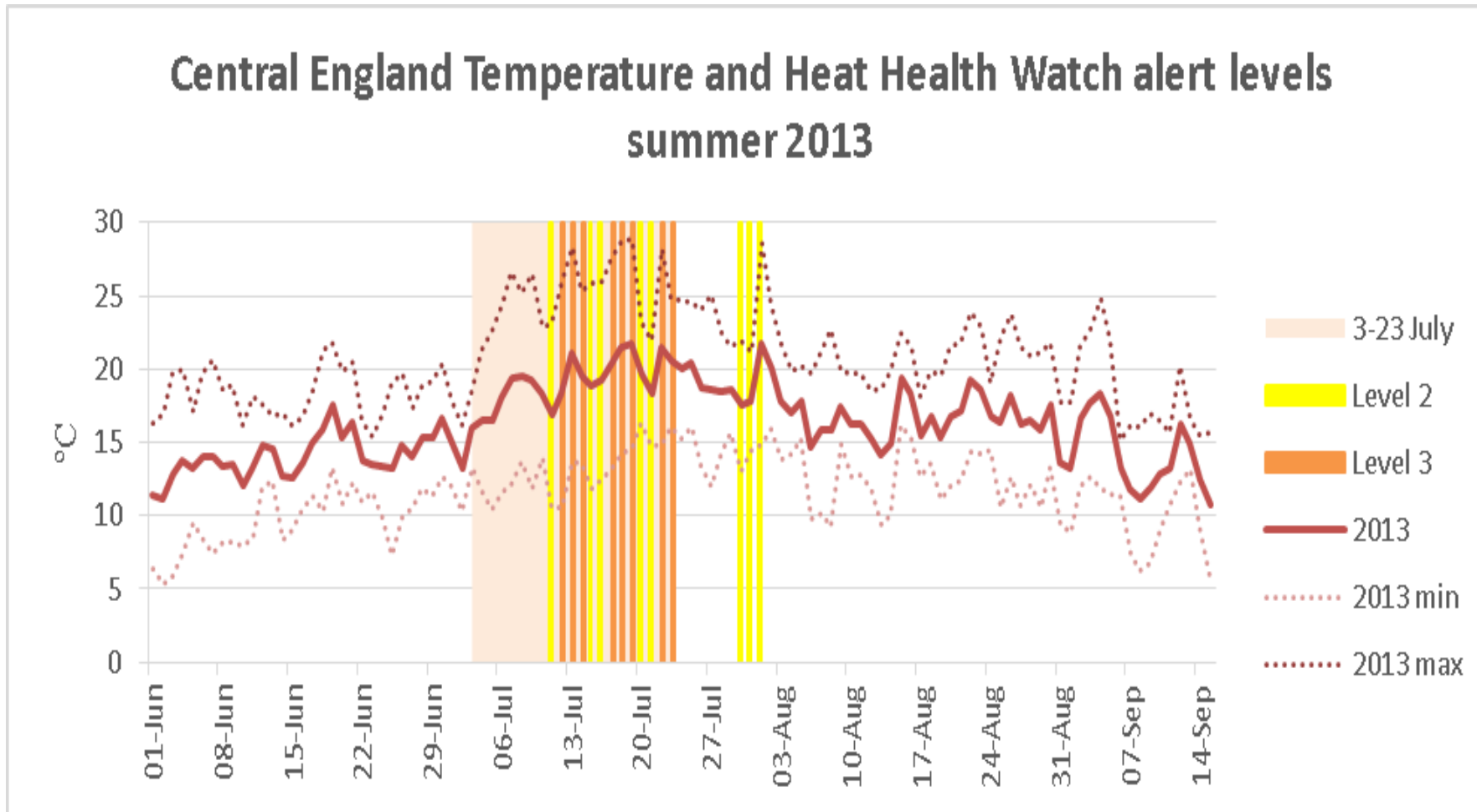
Evidence for interventions

- ▶ What to do?
- ▶ When to do it?
- ▶ Acute peak in daily mortality, Greater London, 2003



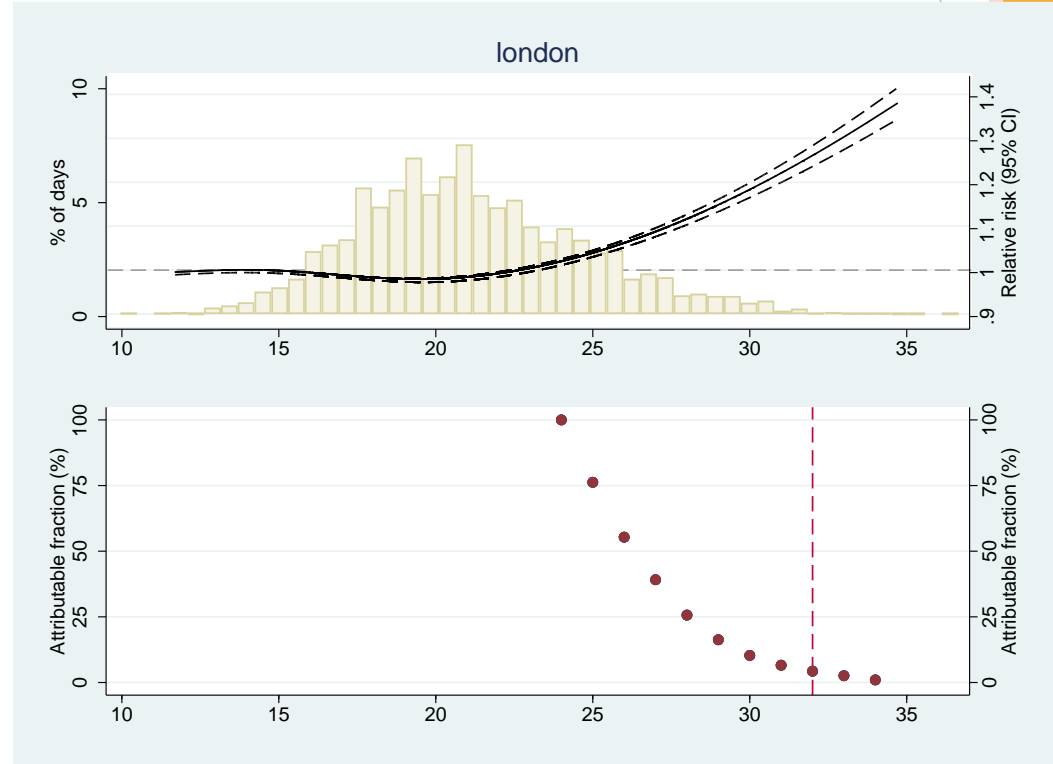
Source: ONS

Climate alerts



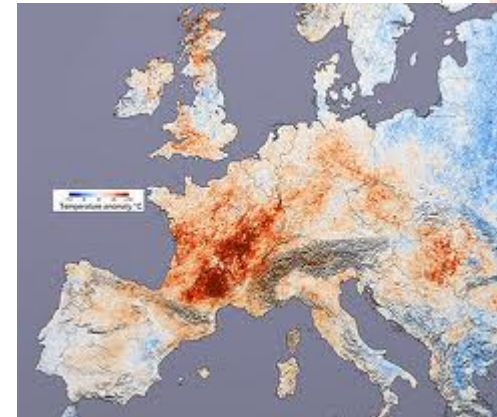
Burden of heat deaths

- ▶ London
- ▶ The majority of heat related deaths occur below the “heat alert” threshold.

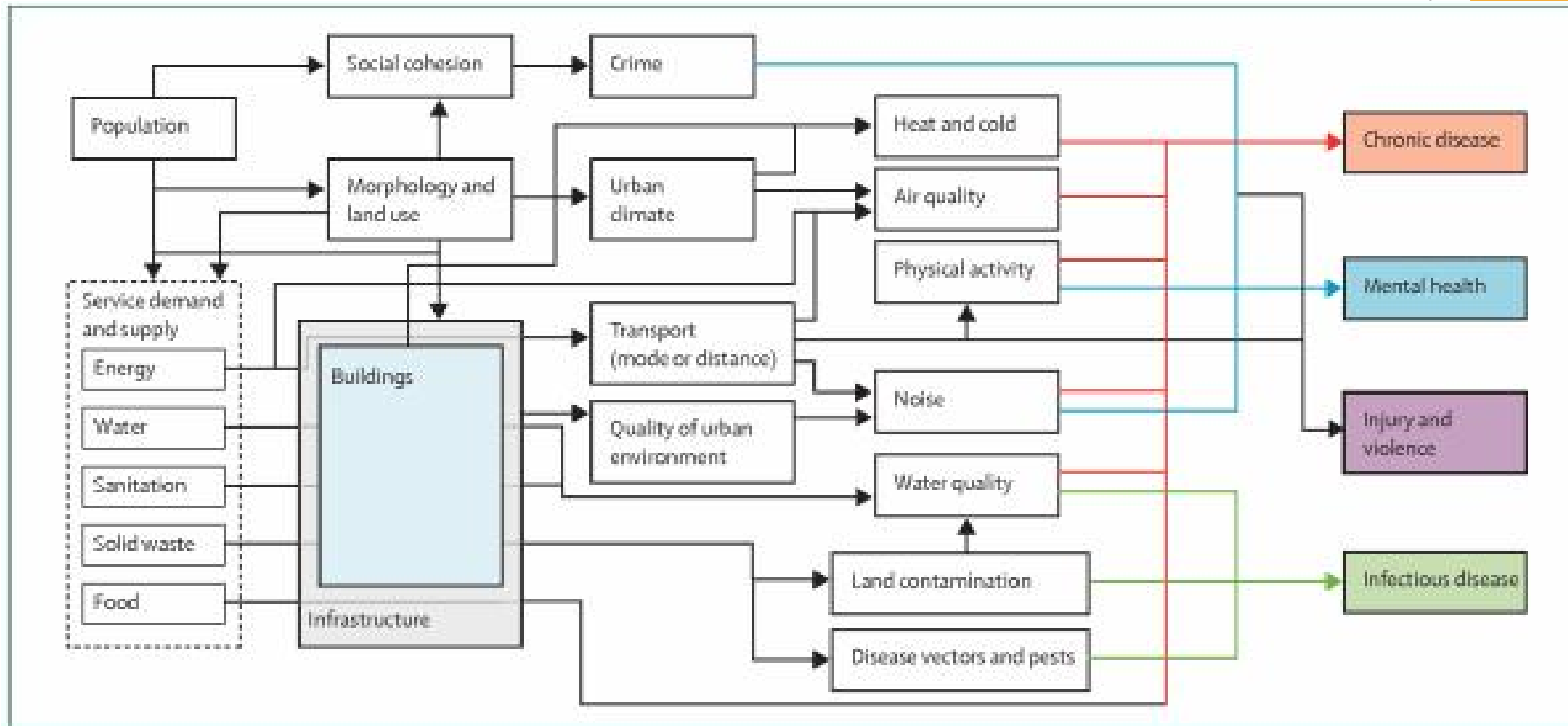


Extreme weather and multiple risks

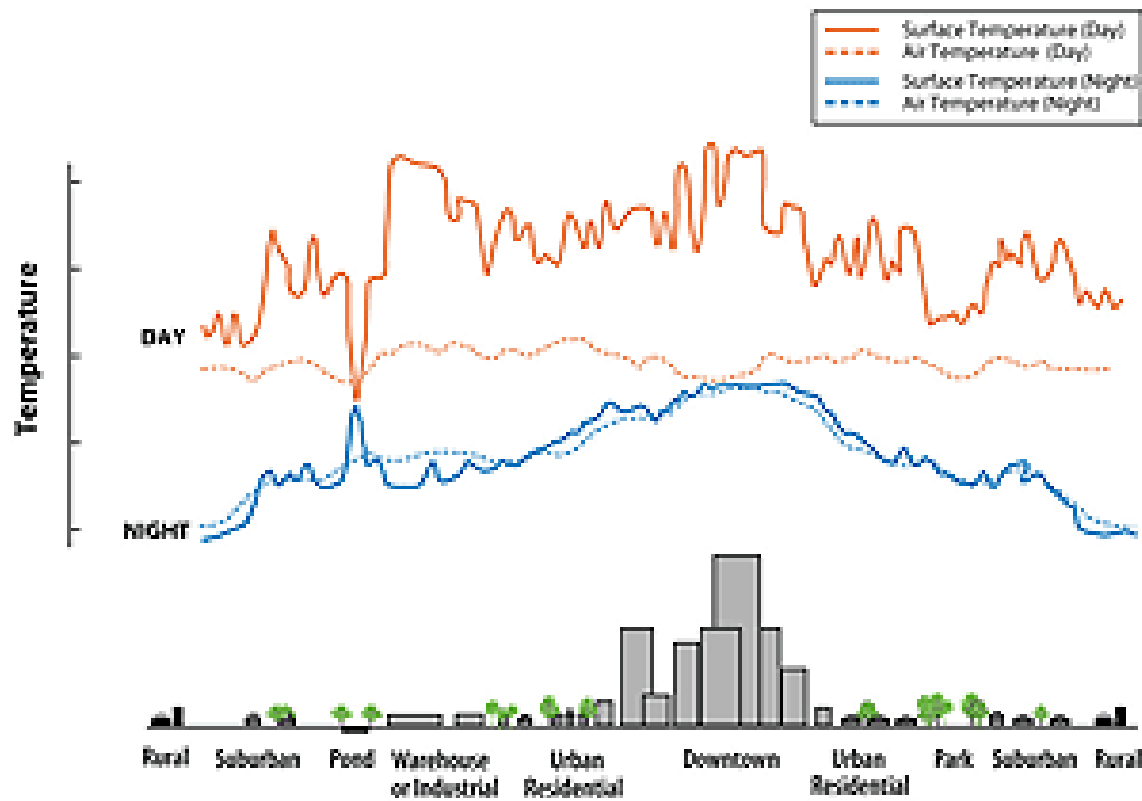
- ▶ 2003 Heat wave, central Europe
 - ▶ Hottest summer in at least 500 years
 - ▶ 35,000 deaths in August in Central and Western Europe
 - ▶ Damage to road and rail transport systems.
 - ▶ Risk to nuclear power generation in France.
 - ▶ Power outages
 - ▶ Grain harvest losses of 20%
 - ▶ Decline in water quality associated with low river flow
 - ▶ Air pollution episode
 - ▶ Forest fires



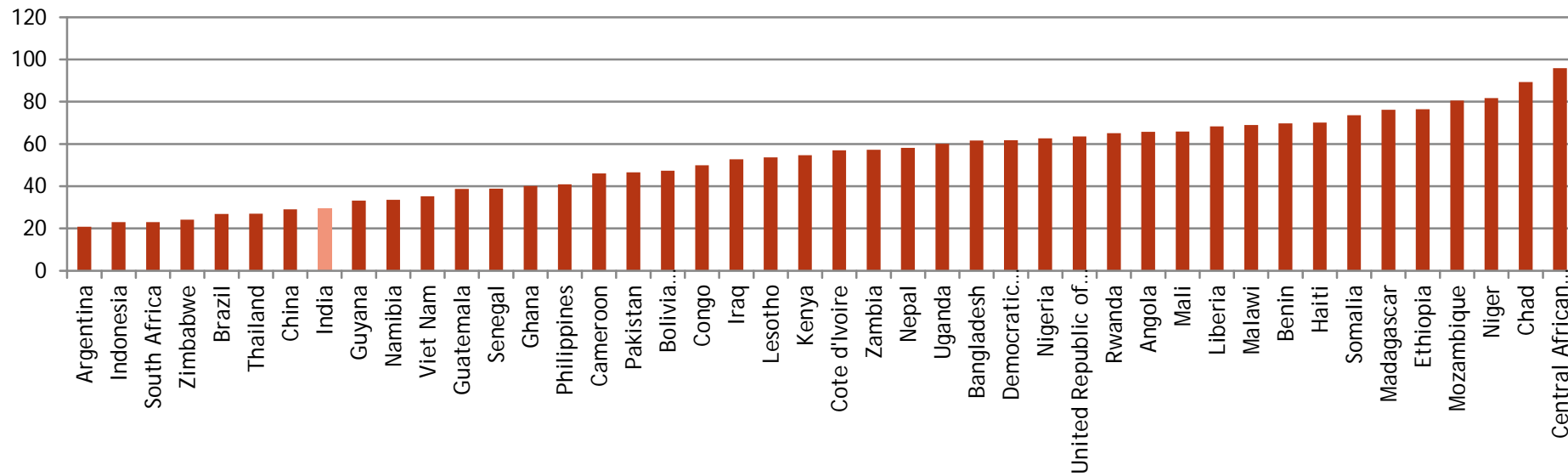
Health outcomes and the urban environment: connections



Built environment



Proportion of urban residents living in a slum area



Low quality housing and health in urban Africa

Household survey 1999 - Port Elizabeth, South Africa

- ▶ overcrowding
- ▶ lack of access to decent sanitation
- ▶ Pests
- ▶ indoor air pollution from paraffin burning
- ▶ outdoor air pollution from dust and the burning of waste.
- ▶ damp
- ▶ extremes of temperature
 - ▶ > 50% of those living in shacks reported installing insulation (e.g. paper, cardboard, or wood) to reduce temperature fluctuations and condensation.

“Temperature variations in poorly insulated and poorly ventilated shacks can be extreme, with potentially hazardous high temperatures for infants being reached on sunny days with no wind”

Knowledge gaps

- ▶ What do we know?
 - ▶ Multiple outcomes/mechanisms
 - ▶ New methods
 - ▶ Scale - individual, household, community, city, country, region, global
- ▶ Regions/countries
 - ▶ Impacts in low income populations
- ▶ Determinants/risk factors
 - ▶ Social factors
 - ▶ Housing/built environment
- ▶ What do we need to know - how to provide evidence for heat planning/protection
 - ▶ Burdens - how big is the impact? What is the cost?
 - ▶ High risk groups- who is most affected, who would benefit from intervention?

Session tomorrow..

part 1. Population based studies

Benjawan Tawatsupa	Association between temperature and health outcomes of population in Thailand
Francesco Chesini	Analysis of mortality during heatwaves 2013-2014 in Argentina
Joan Ballester	Recent trends in temperature, vulnerability and heat-attributable mortality in Europe
Peter Kim Sreatfield	Identifying and attributing heat effects in rural Bangladesh

part 2. Physiological studies/Occupational health

Andreas Flouris	Impacts of occupational heat strain on health and productivity: systematic review
Ollie Jay	Should electric fans be used in a heatwave?
Jason Lee	Meta-analysis to evaluate the effectiveness of heat injury reduction measures

part 3. Studies on heat perceptions and behaviour

Lam Holly	Personal heat protective measures during the 2017 heatwave in Hong Kong: A telephone survey study
Ashley Ward	Identifying and engaging with groups vulnerable to heat risks.

part 4.

Key messages