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DCEE

Climate Change and its impact on neurological conditions

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Declarations of Interest

None

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BRAIN
EDITORIAL

Call for emergency action to limit global temperature increases, restore biodiversity and protect health

Wealthy nations must do much more, much faster†

For numbered affiliations see end of article.

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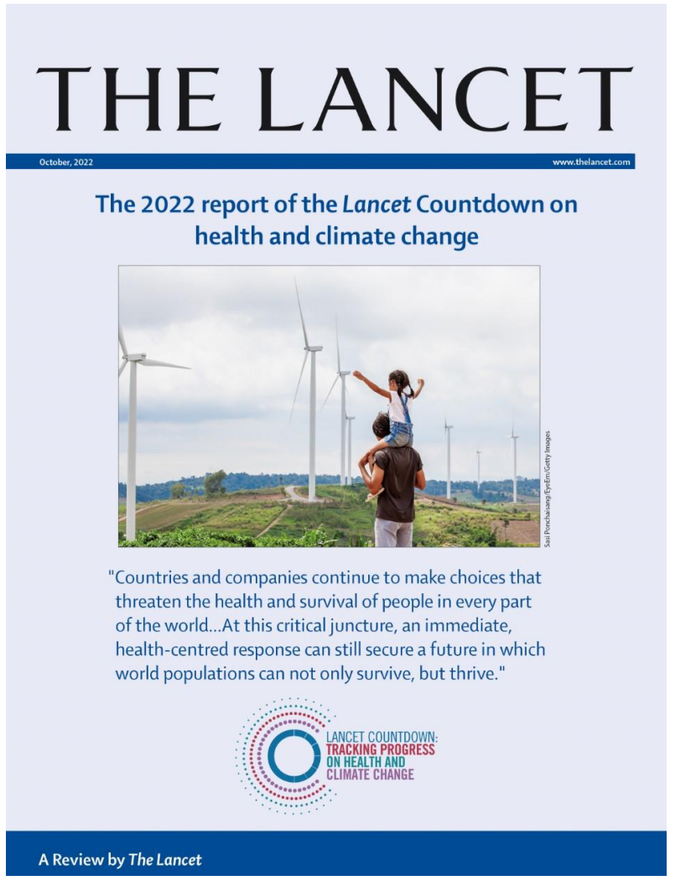


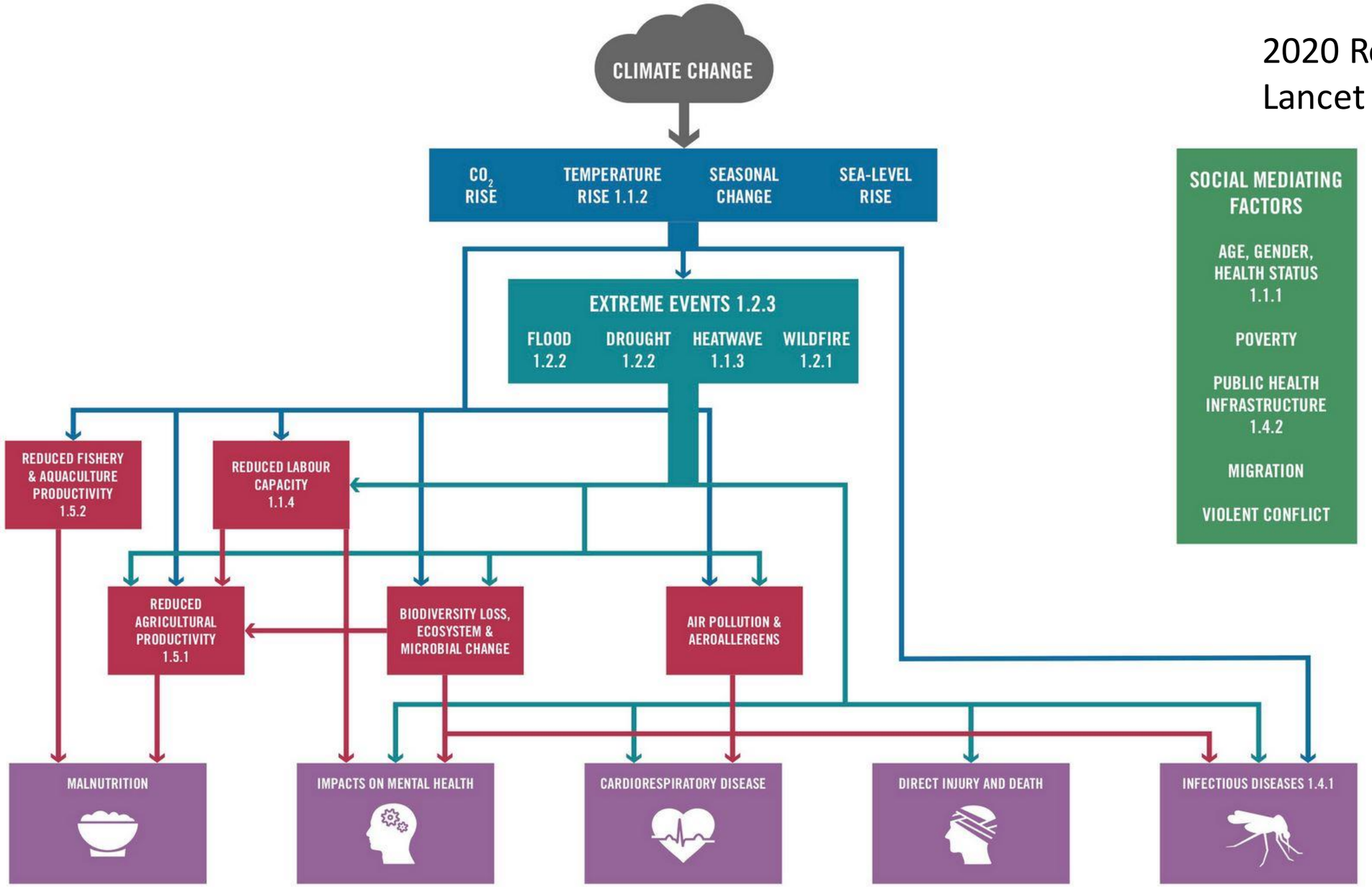
Time to treat the climate and nature crisis as one indivisible global health emergency

Joint action is essential for planetary and human health

Kamran Abbasi, [1] Parveen Ali, [2] Virginia Barbour, [3] Thomas Benfield, [4] Kirsten Bibbins-Domingo, [5] Stephen Hancocks, [6] Richard Horton, [7] Laurie Laybourn-Langton, [8] Robert Mash, [9] Peush Sahni, [10] Wadeia Mohammad Sharief, [11] Paul Yonga, [12] Chris Zielinski[13]

Climate Change affects everything in the world

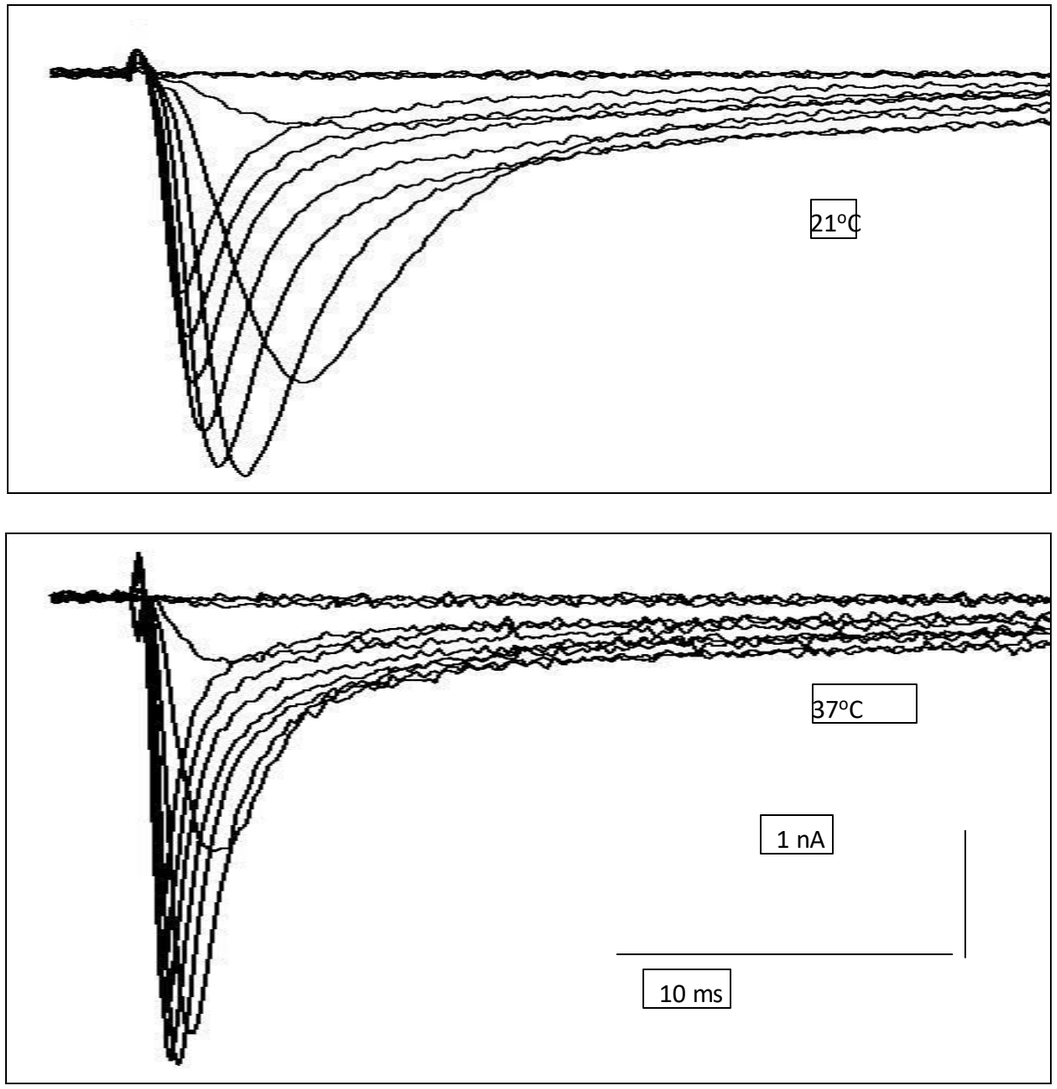
2020 Report of the Lancet Countdown



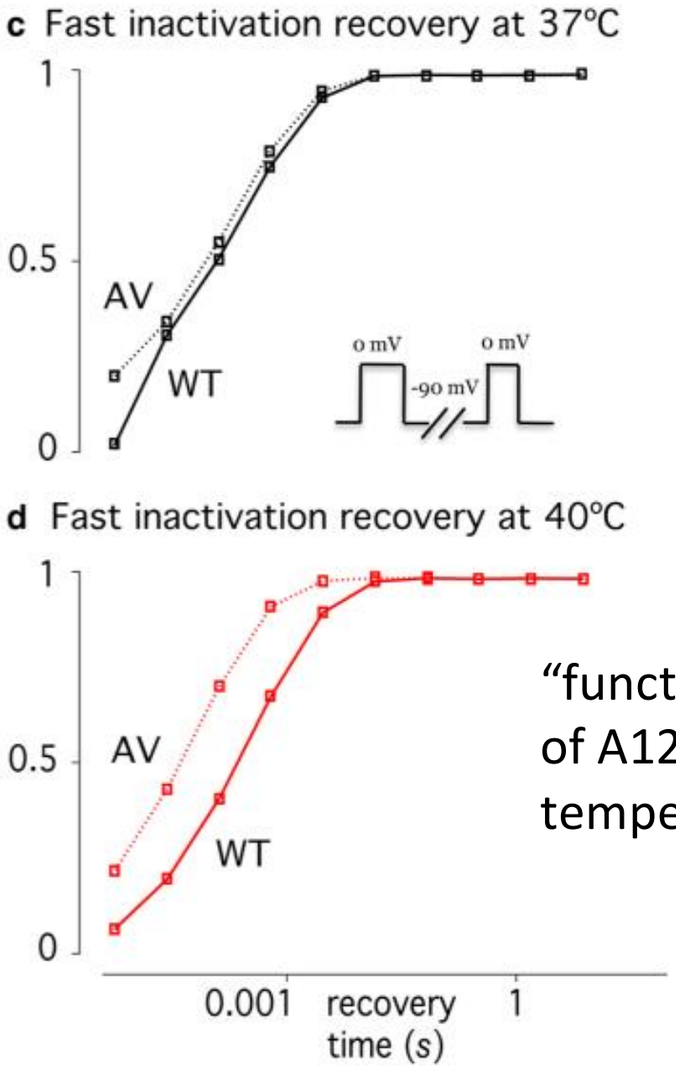
Climate Change affects everything in *our* world

- Thermoregulation depends on activity of the nervous system
- Thermoregulation can be compromised by diseases of the nervous system
- Thermoregulation has its limits
- Neurological diseases can be affected by climate change
- Brain function and climate change in healthy individuals

Ambient temperature can affect ion channel function



Fletcher et al.
J Biol Chem. 2011;286:36700-8



"functional impairments of A1273V are temperature-specific"

Peters et al. 2016
Sci Rep. 2016 Sep 1;6:31879

THE LANCET Neurology

Personal View

Climate change and disorders of the nervous system

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See Comment page 552

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Anthropogenic climate change is affecting people's health, including those with neurological and psychiatric diseases. Currently, making inferences about the effect of climate change on neurological and psychiatric diseases is challenging because of an overall sparsity of data, differing study methods, paucity of detail regarding disease subtypes, little consideration of the effect of individual and population genetics, and widely differing geographical locations with the potential for regional influences. However, evidence suggests that the incidence, prevalence, and severity of many nervous system conditions (eg, stroke, neurological infections, and some mental health disorders) can be affected by climate change. The data show broad and complex adverse effects, especially of temperature extremes to which people are unaccustomed and wide diurnal temperature fluctuations. Protective measures might be possible through local forecasting. Few studies project the future effects of climate change on brain health, hindering policy developments. Robust studies on the threats from changing climate for people who have, or are at risk of developing, disorders of the nervous system are urgently needed.

The Lancet Neurology, published 15.5.24

Neurological conditions: stroke

Vulnerable

- Age
- Altered temperature perception and disordered thermoregulation
- Co-morbidities, including pre-existing cardiovascular risk factors, medications

Meta-analysis (>2 million events):
short-term mean ambient temperature rises increase ischaemic stroke risk (1·2% per 1°C)
(Lian et al. Int J Environ Res Public Health 2015; 12: 9068–88)

Increased rates of admission and mortality with increased ambient temperature
Increased rate of admission with cold extremes, especially for haemorrhagic stroke

Complex relationships

temperature, diurnal range, time lag
unseasonal extremes, duration of extreme temp

pollution
built environment

urban-rural setting
socioeconomic status

The Lancet Neurology, published 15.5.24

Neurological conditions: dementia

People with dementia vulnerable through additional existing burdens:

- cognitive impairment - compromised ability to take action or seek help
- behavioural issues
- reduced awareness of risk

Increased hospital admission rates:

New England, USA: 12% higher for each 1.5C increase in mean summer temp
Madrid, Spain: 23% higher for each 1C above heatwave threshold (34C)
England: 4.5% higher for each 1C above 17C

Psychiatric conditions

Higher ambient temperatures associated with increased incidence, admission and mortality rates

California, USA: ~5-8% higher rate of hospital visits for each 5.6C rise
Bern, Switzerland: 4% higher risk of hospitalization for every 10C increase in daily temperature
UK: ~5% higher risk of death per 1C rise above specified threshold temperature

The Lancet Neurology, published 15.5.24

Disorders of the nervous system

Factors that are relevant

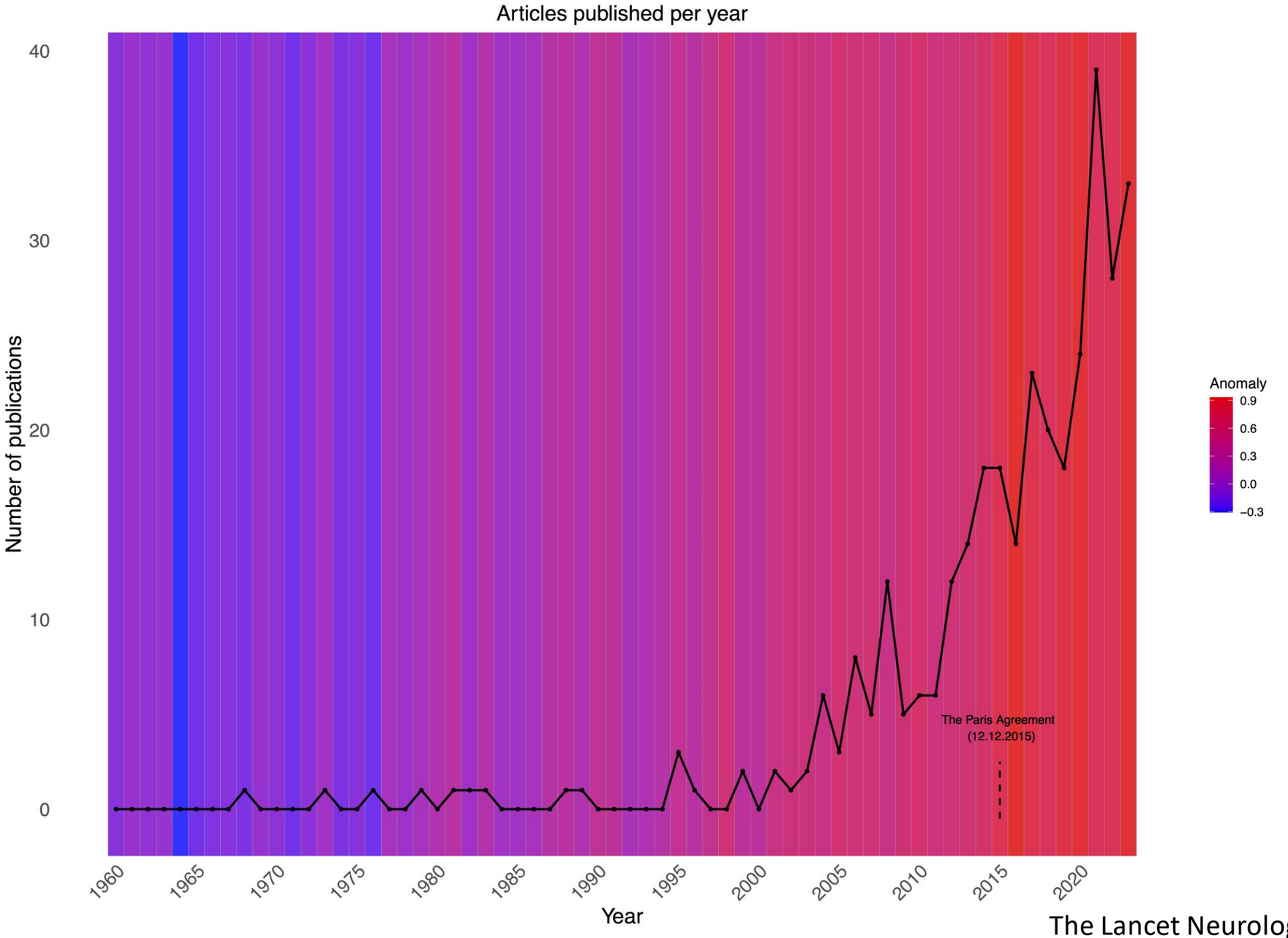
- Unseasonal local temperature extremes
- High and low extremes
- Diurnal excursion
- Humidity
- Lag effects
- Night-time temperatures

Factors that need consideration

- Definitions and methods
- Treatment of climate factors
- Global inequalities
- Genetic adaptation and susceptibility
- Urban-rural and indoor/building effects
- Local factors – green and blue spaces
- Vector behaviour
- Human behaviour; vaccination
- Socioeconomic stratification
- Pollution
- Climate and disease forecasts

The Lancet Neurology, published 15.5.24

More work needed



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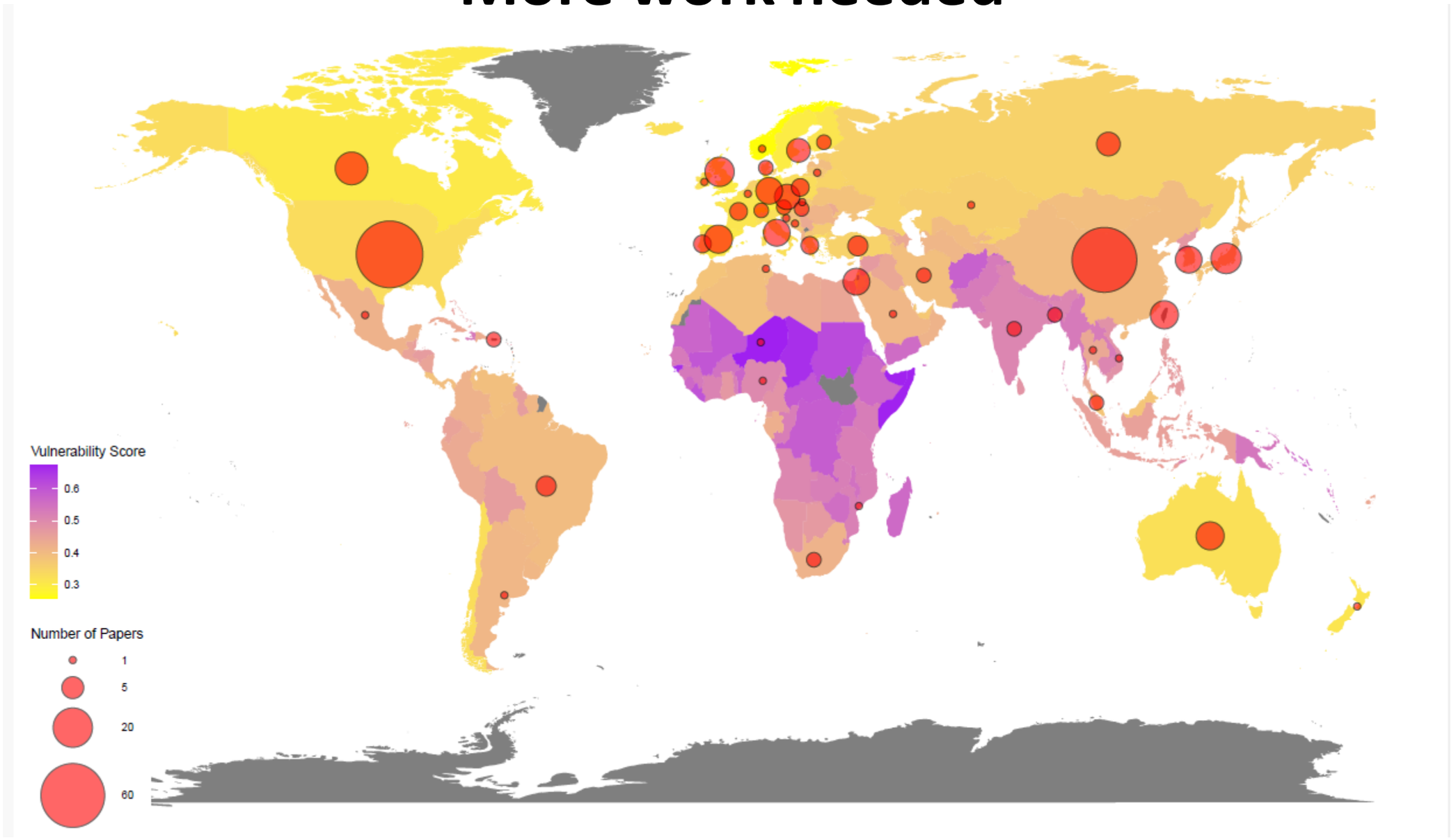
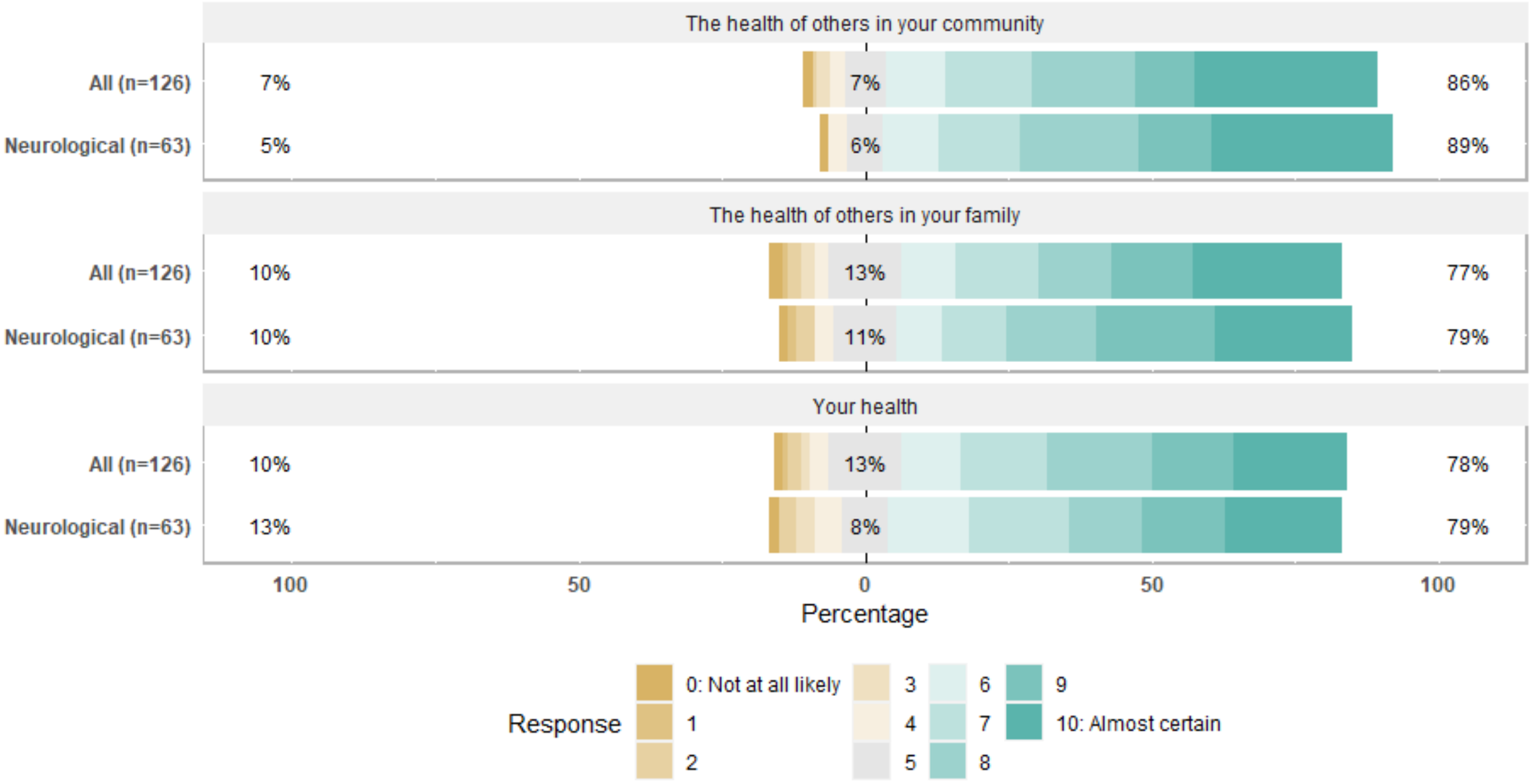


The Lancet Neurology, published 15.5.24

Attitudes and concerns of the neurology community

How likely will…be harmed by heatwave in next 5 years?



Blenkinsop et al. Epilepsia 2024 Jan;65(1):95-106

What should we do?

Governmental

Institutional

Work-place

Personal

X

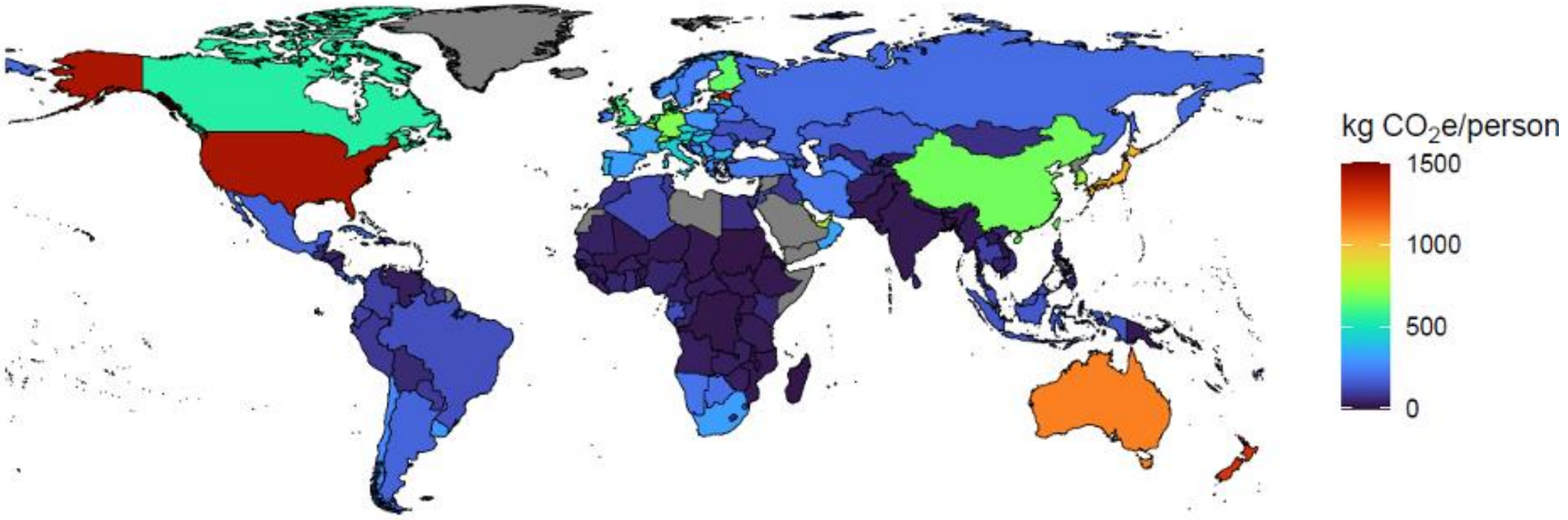
Raise awareness

Promote research

Take action

Now!

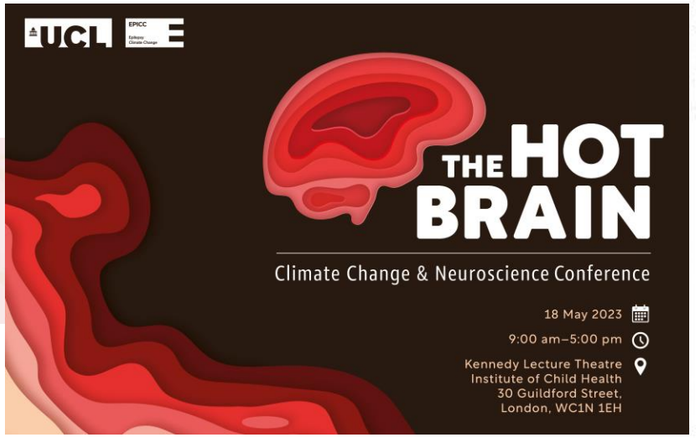
The global health system accounts for 10% of global GDP, and contributes to **4.6% of total GHG emissions**. Healthcare-associated $PM_{2.5}$ and ozone air pollution is responsible for **4 million Disability-Adjusted Life Years (DALYs) annually.**



National per-capita GHG emissions from the healthcare sector in 2020. Data are not available for the countries in grey

Institutional

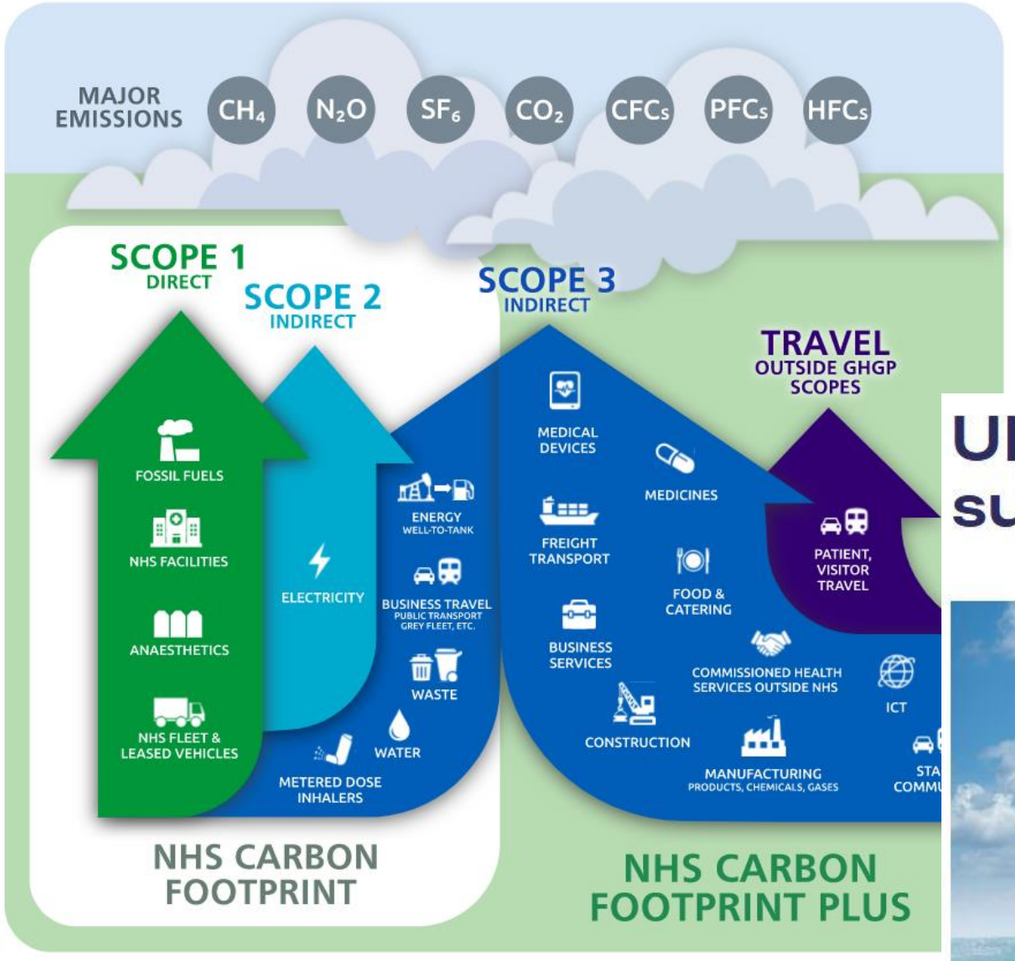
- Awareness: webinars, talks, fora, meetings, newsletters



- Research: international collaboration
  eg heatwave effects on people with epilepsy, seasonal influences on lab models

- Action: formal external review of ILAE investment portfolio
  making congresses more sustainable
  making sustainable actions easier, unsustainable less attractive

Have the conversation



UKRI welcomes cross-sector environmental sustainability concordat

25 April 2024

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What can be done?

NIHR | National Institute for Health and Care Research

Carbon reduction guidelines: 19 recommendations

- Setting the research question and making full use of existing evidence
- Efficient study design
- Study set up and conduct
- Avoiding unnecessary data collection
- Sensible clinical trial monitoring
- Good practice in reporting research
- Reducing the environmental impact of the NHS through research

www.nihr.ac.uk/documents/the-nihr-carbon-reduction-guidelines/21685

Carbon reduction in trials is possible

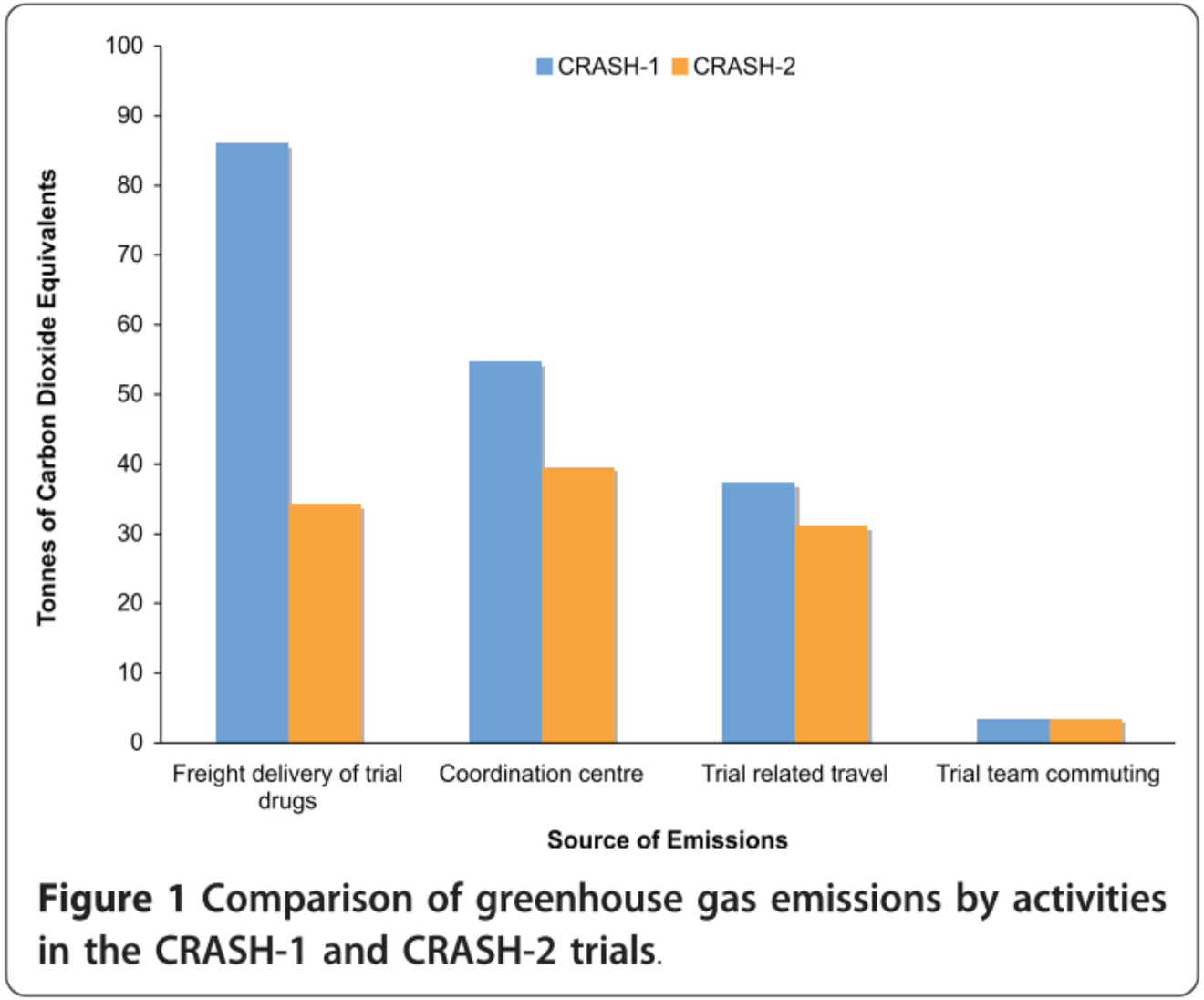

Figure 1 Comparison of greenhouse gas emissions by activities in the CRASH-1 and CRASH-2 trials.

CRASH

CRASH-2

Clinical Randomisation of an Antifibrinolytic in Significant Haemorrhage

Trials 2011;12:31

Is climate change relevant for this patient?	There may be biological reasons to think so, for example, many channelopathies, demyelinating diseases, conditions which impair internal or external thermoregulatory responses
Introducing the topic	This may come up spontaneously, or can be directly probed - the patient notes their condition was worse during a recent heatwave -during a review of the patient's condition, ask whether there are factors that aggravate their condition -if in or near a heatwave or cold spell, it would be natural to ask how the patient fared during the adverse weather
Find out more	What was the problem? What made things better or worse? What is the patient already doing to manage the issues?
Offer advice and solutions	Give advice on managing extreme heat or cold Provide links to Government advice and guidance Direct to charity or other support groups Underline the importance of getting a good night's sleep, and measures to do so Provide information on practical measures for cooling and keeping medication safe
Plan for the future	For people with chronic neurological diseases, discuss planning for more frequent and severe adverse weather events

An example: routine follow-up consultation with a patient and family who had been seen for many years, after a recent heatwave. I asked how the patient, who has epilepsy with multiple comorbidities due to a genetic condition, had fared through the heatwave. His mother explained that higher temperatures were always a problem, always led to more seizures, and that heatwaves were a particular problem, and that they had fans everywhere in the house, and avoided going out altogether during heatwaves. None of this had been previously documented, but was part of the family's life. The mother noted that there was nothing one could do about the weather. This led to a discussion both about managing acutely in heatwaves (e.g. cool towels over the neck region can be helpful, provision of additional weblinks) and about future care in a warming world with more heatwaves expected, as the family were planning a self-contained extension to the family home.

Practical Neurology 2024 Jan 23;24(1):28-36

Green (summer preparedness) - No alert will be issued as the conditions are likely to have minimal impact on health. However, during periods where the risk is minimal it is important that organisations ensure that they have plans in place and are prepared to respond should an alert (yellow, amber or red) be issued.

Yellow (response) - These alerts cover a range of situations. Yellow alerts may be issued during periods of heat which would be unlikely to impact most people, but those you are particularly vulnerable (e.g. the elderly with multiple health conditions and on multiple medications) and are likely to struggle to cope and where action is required within the health and social care sector specifically. A yellow alert may also be issued if the confidence in the weather forecast is low, but there could be more significant impacts if the worst-case scenario is realised. In this situation the alert may be upgraded as the confidence in both the weather forecast and the likelihood of observing those impacts improves.

Amber (enhanced response) - An amber alert would represent a situation in which the expected impacts are likely to be felt across the whole health service, with potential for the whole population to be at risk and where other sectors apart from health may also start to observe impacts, indicating that a coordinated response is required. In addition, in some circumstances a National Severe Weather Warning Service (NSWWS) Extreme Heat warning may be issued in conjunction with and aligned to the HHA. This situation would indicate that significant impacts are expected across multiple sectors.

Red (emergency response) - A red alert would indicate significant risk to life for event the health population. A red warning would be issued in conjunction with and aligned to a red NSWWS Extreme Heat warning. Several impacts would be expected across all sectors with a coordinated response essential.

https://www.metoffice.gov.uk/weather/warnings-and-advice/seasonal-advice/heat-health-alert-service

‘Adverse Weather and Health Plan’

UK HSA

Climate Anxiety

- Everyone
- Young people
- People at greater risk

Study of 10,000 young people in 10 countries around the world

Hickman et al. The Lancet Planetary Health 2021;5:e863-e873.