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# Why do **heat** and **air** matter for **longevity**?

**Longevity17**
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*Decreased longevity?*
**The physical risk of heat**
*Increased longevity?*
**The transition risk of air quality**
*Uncertainty:*
**Scenarios and adaptation**

# Heat

## How is the body affected?

**Heart** – blood pressure falls when blood moves from central organs to periphery for cooling, heart beats faster, can cause fainting, even heart failure

**Brain** – hypothalamus is thermostat, nerve cell malfunction, personality changes, clumsiness, may never fully recover in up to 20% of heatstroke cases

**Kidneys** – control water and salt, lost through sweat, recurrent heat stress and dehydration causes chronic kidney disease

**Gut** – blood moves to periphery, lack of oxygen causes inflammation, nausea, vomiting, flare-ups of inflammatory bowel disease

Too hot to handle: can our bodies withstand global heating? | Cop26 | The Guardian

## Who is most vulnerable?

Elderly, less abled and already infirm

Infants, children and pregnant women

Outdoor and manual workers

Athletes

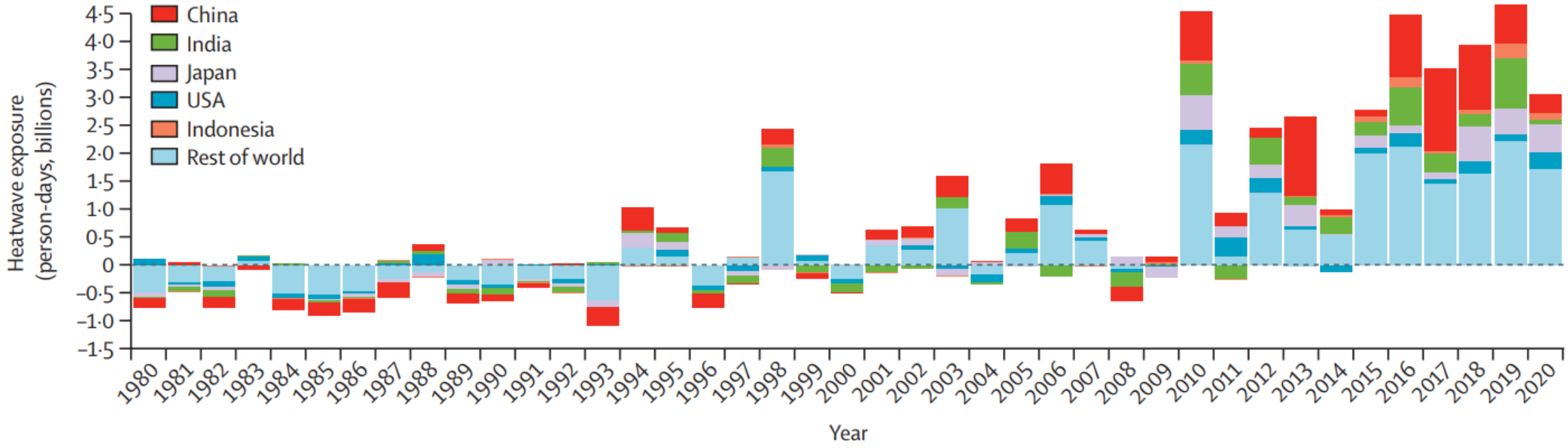
Poor, displaced and homeless

Heat and Health (who.int)

# People are exposed to increasingly more hot days

Change in person-days of heatwave exposure relative to the 1986-2005 baseline:
People older than 65 years

[The 2021 report of the Lancet Countdown on health and climate change: code red for a healthy future - The Lancet]



# Hot days are increasing in both frequency and intensity

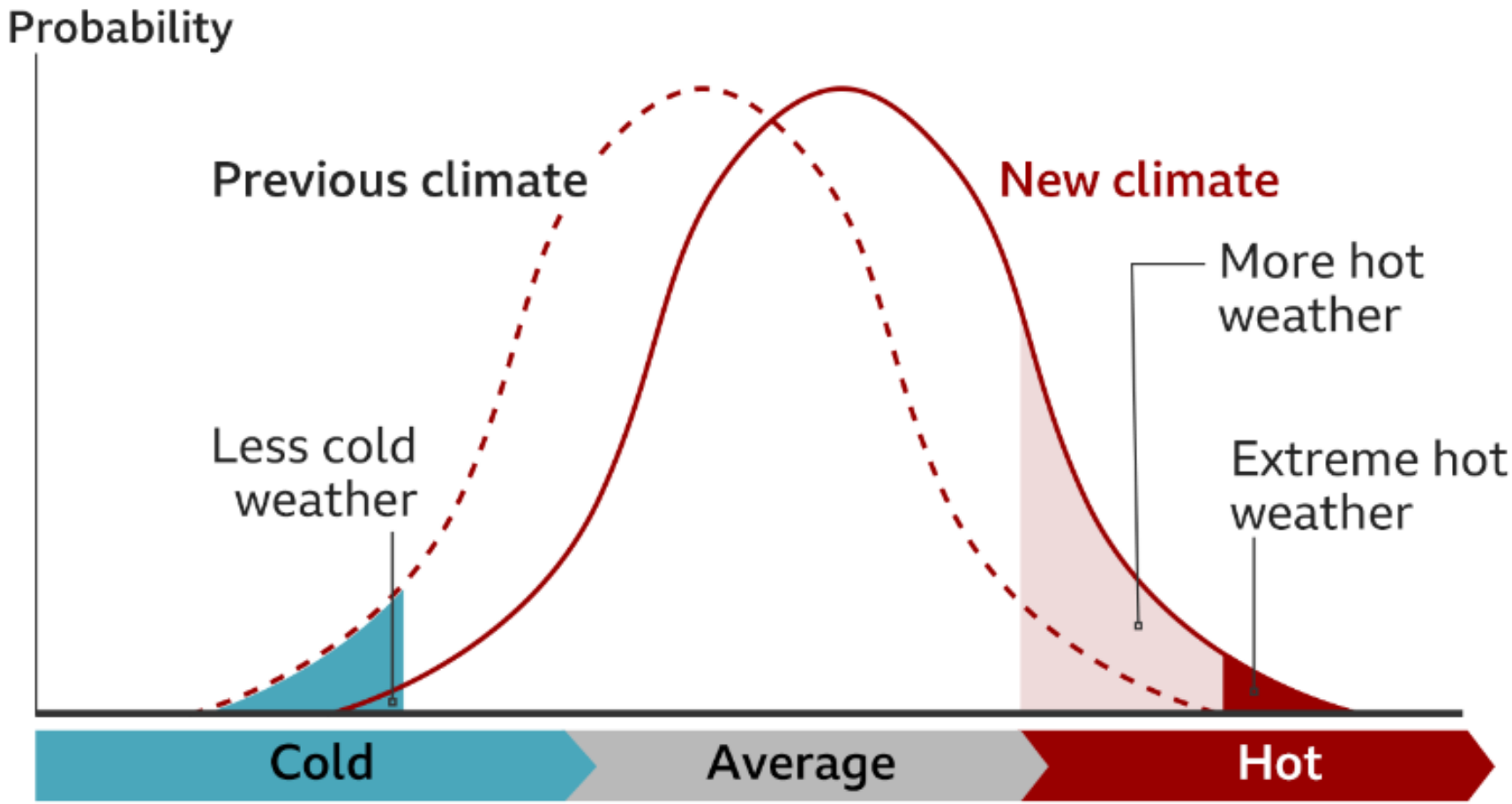
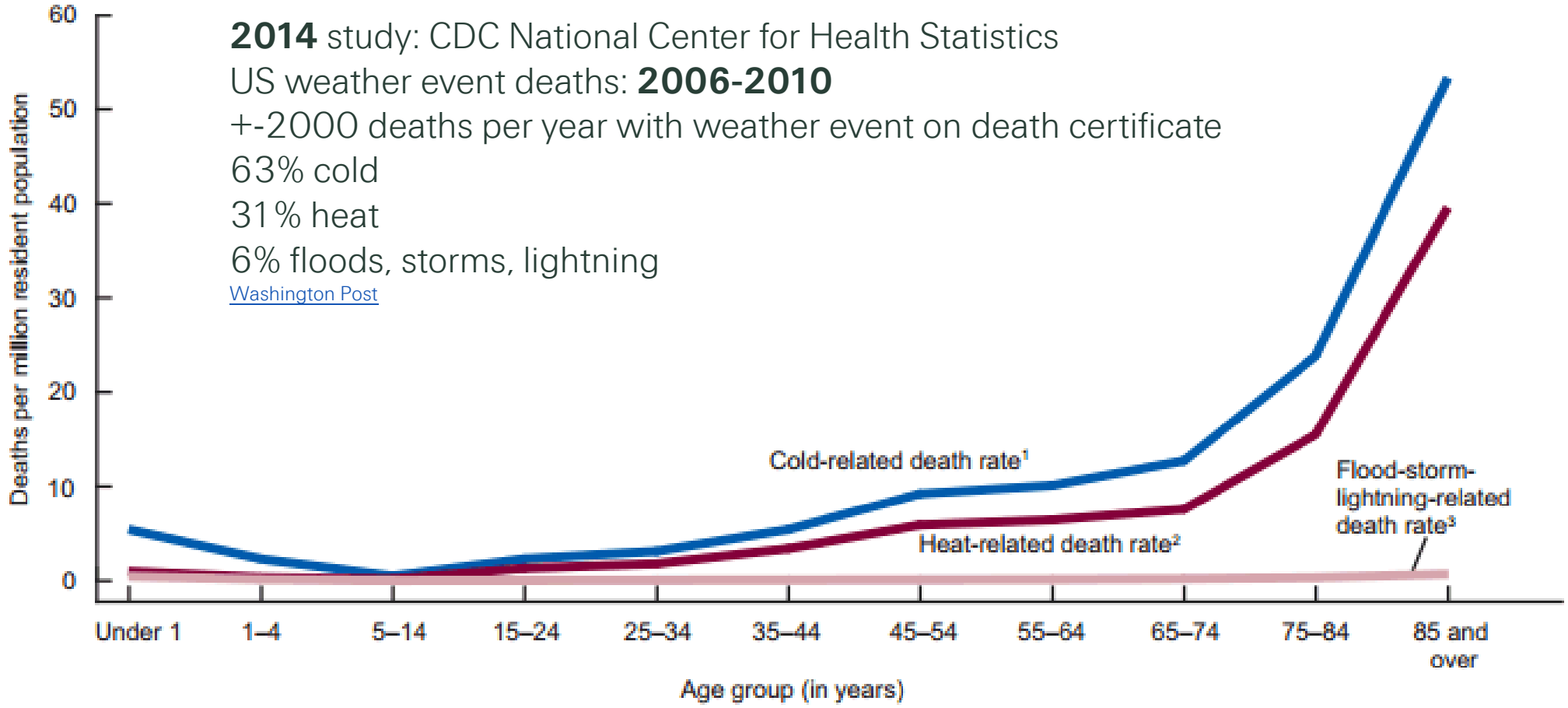



Image credit: BBC

# We can expect a shift in deaths from extreme cold to extreme heat

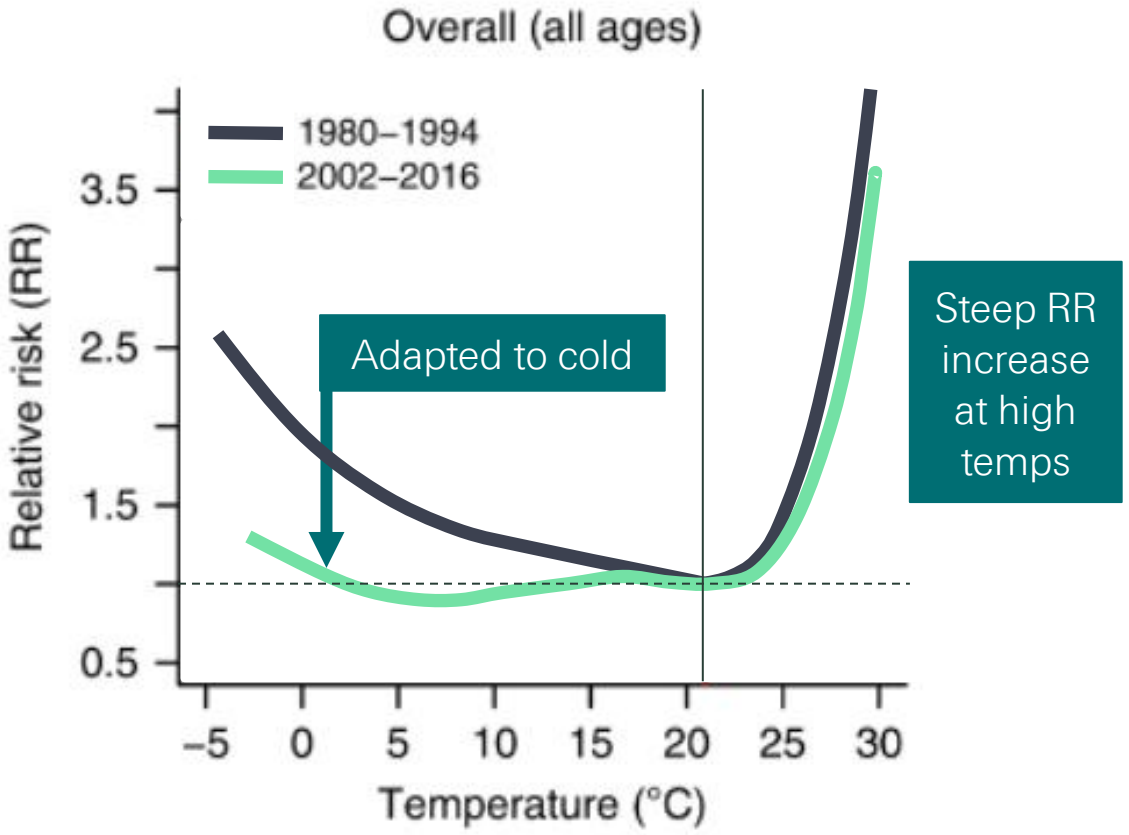
**2014** study: CDC National Center for Health Statistics
US weather event deaths: **2006-2010**
+-2000 deaths per year with weather event on death certificate
63% cold
31% heat
6% floods, storms, lightning
Washington Post

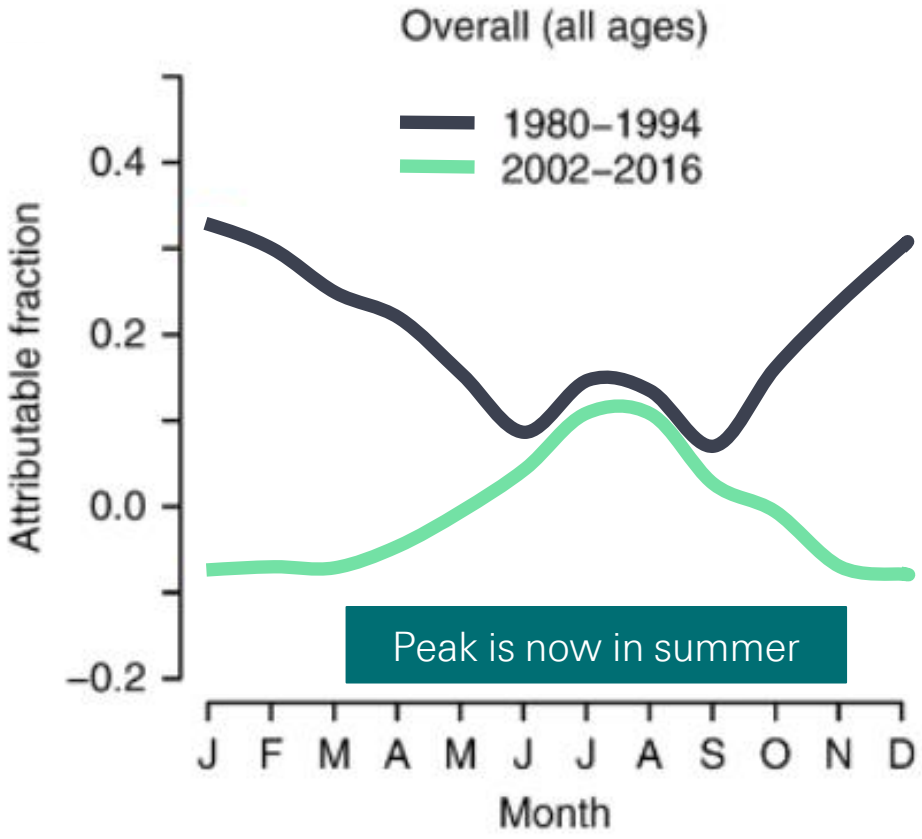


# We have learnt to adapt to cold, and now deaths are reversing in seasonality

Respiratory disease deaths in Spain: 1980 - 2016

Reversal of the seasonality of temperature-attributable mortality from respiratory diseases in Spain | Nature Communications



# Air

## What is Particulate Matter?

Extremely small particles that enter via the lungs, absorbed by blood, and spread within the body

< 1/5 of width of a hair: PM10

< 1/20 of width of a hair: PM2.5

Released by:

- Burning fossil fuels
- Climate-related wildfires


## Why does air quality matter?

**7m** premature deaths p.a. due to air pollution vs +-60m total

**99%** of the global population breathes air below WHO recommended limits

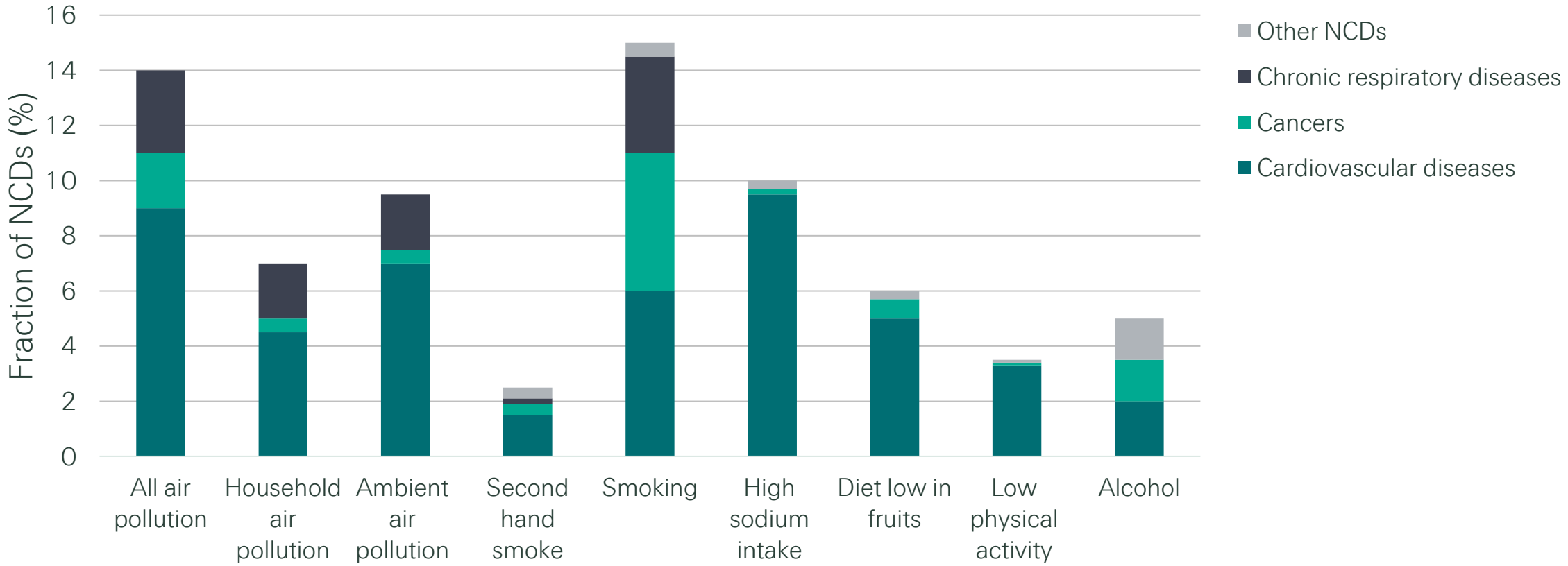
The Lancet Planetary Health

World Economic Forum

# The effect of air pollution to NCDs is equivalent in scale to the effect of smoking

2016 global study

Environmental risks and non-communicable diseases | The BMJ

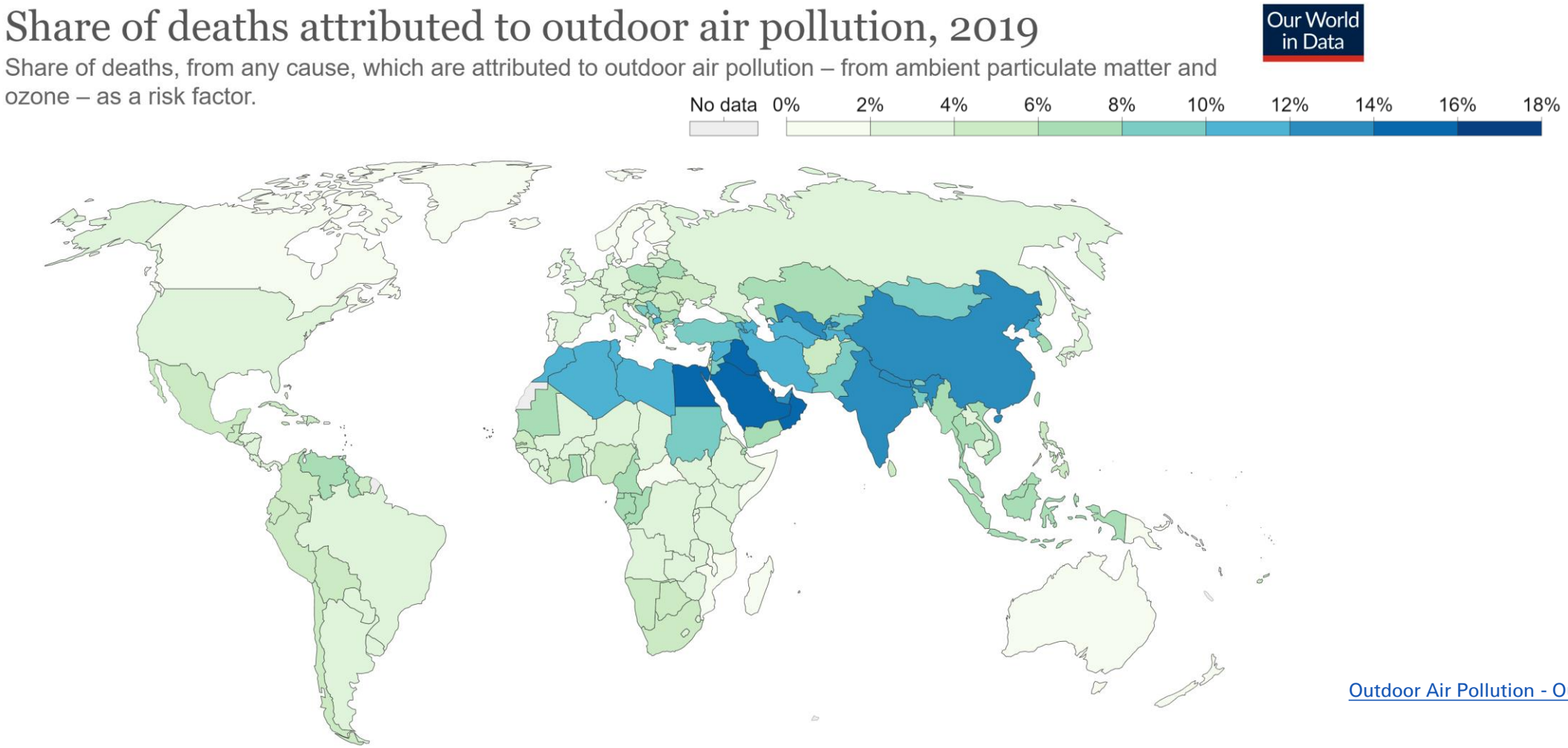


# How much does mortality risk increase when air pollution increases?

- Numerous epidemiological studies
- Study of 29 European countries: respiratory mortality increased by **0.58%** for every 10 µg/$m^3$ increase in PM10
- US Medicare study: Respiratory diseases increased by **2.07%**, hospitalisation rate increased by **8%** for 10 µg/$m^3$ increase in PM2.5
- US cohort study over 7 years: lifespan **0.35 years** shorter for every 10 µg/$m^3$ increase in PM2.5
- American Cancer Society study: increase in mortality **4%**, cardiopulmonary disease mortality **6%** and lung cancer mortality **8%** for every 10 µg/$m^3$ increase in PM2.5
- American Cancer Society cohort study over 26 years: lung cancer mortality increased **15-27%** for 10 µg/$m^3$ increase in PM2.5
- 11 European cohort studies: after balancing smoking and other interfering factors, hazard ratio of lung adenocarcinoma was **2.4** for every 10 µg/$m^3$ increase in PM2.5
- US cohort study over 28 years, National Health Interview Surveys: hazard ratios for all-cause mortality **1.12**, cardiopulmonary mortality **1.23**, lung cancer mortality **1.12** for 10 µg/$m^3$ increase in PM2.5 long-term exposure

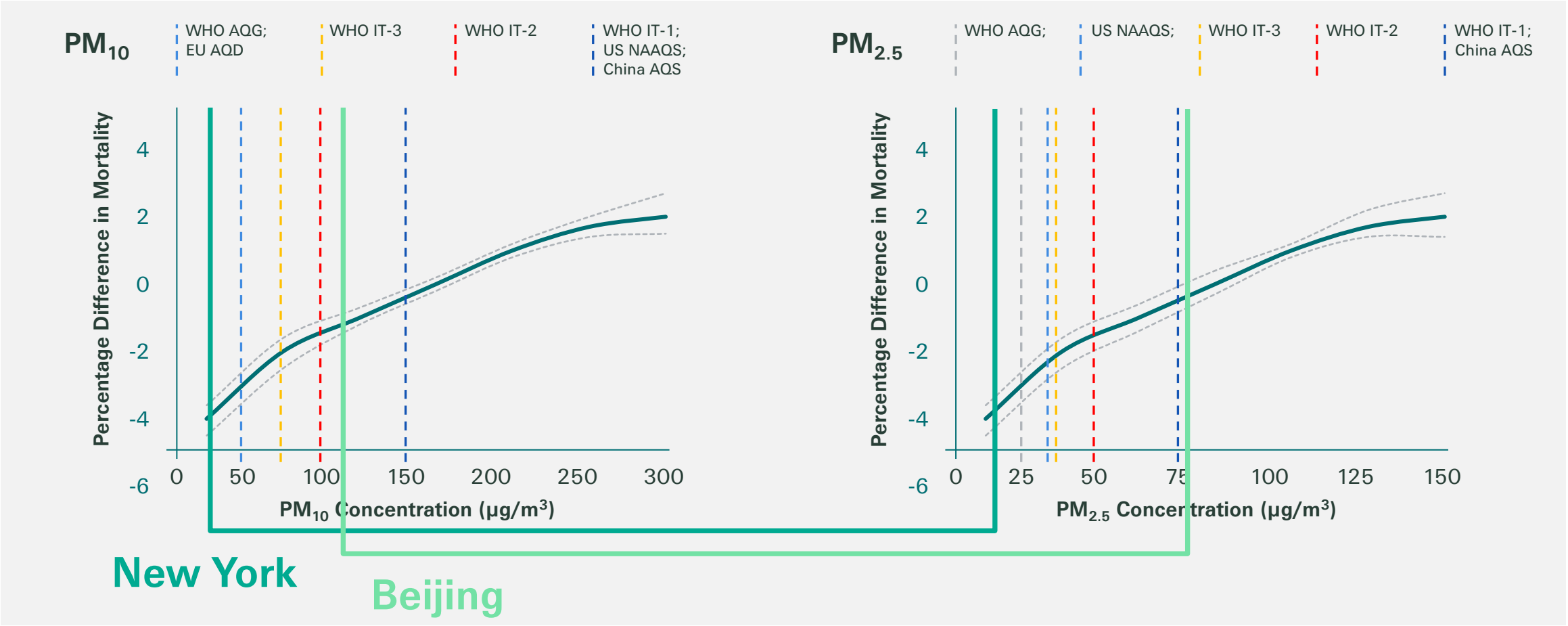
The impact of PM2.5 on the human respiratory system - PMC (nih.gov)
Mortality Risk and Fine Particulate Air Pollution in a Large, Representative Cohort of U.S. Adults | Environmental Health Perspectives | Vol. 127, No. 7 (nih.gov)

# Distribution of % deaths due to outdoor air pollution across the globe



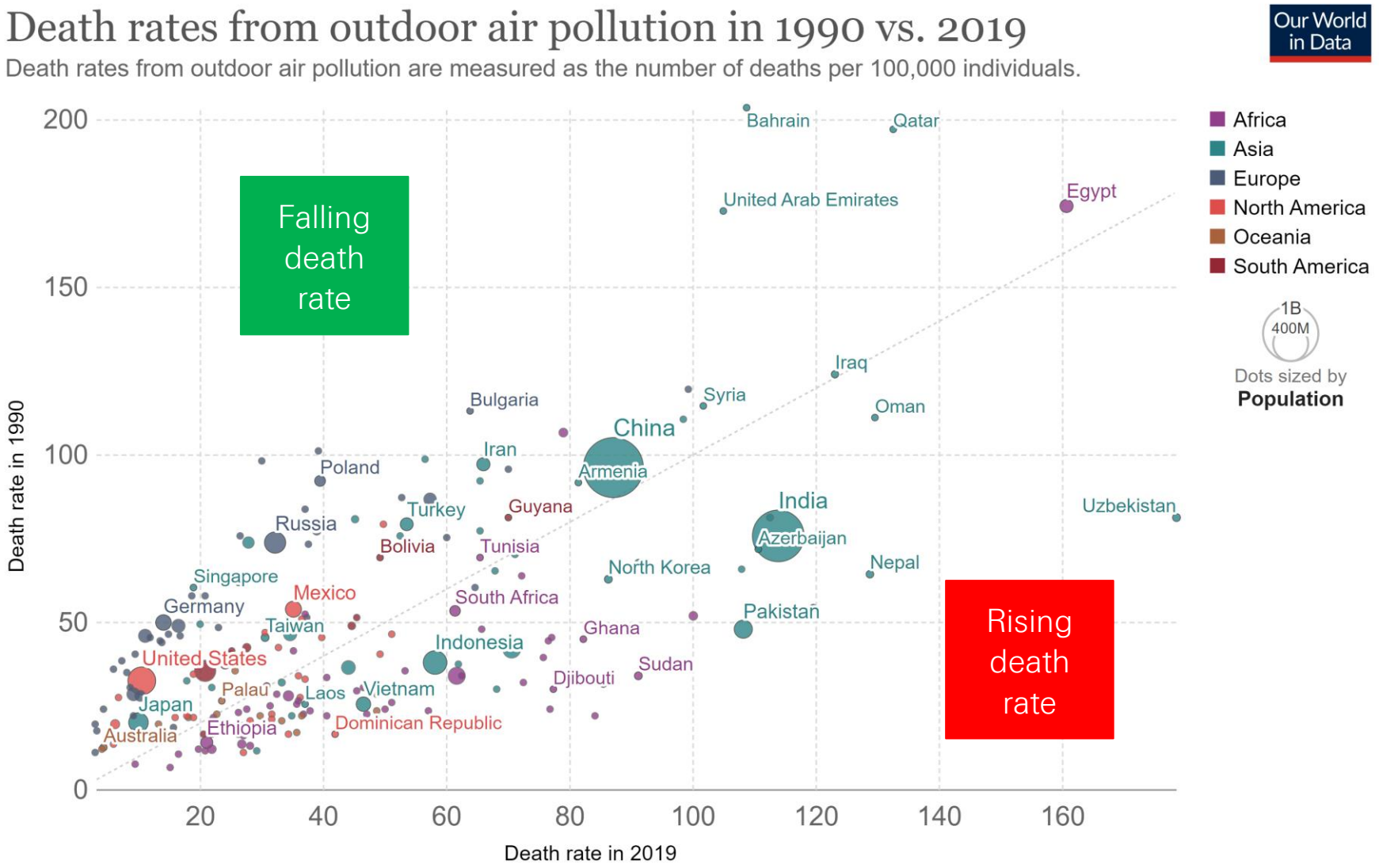

Outdoor Air Pollution - Our World in Data

# How much longer will we live when air pollution falls?




Ambient Particulate Air Pollution and Daily Mortality in 652 Cities | NEJM

# Country movements in outdoor air pollution death rates over the last 30 years




[Outdoor Air Pollution - Our World in Data]

# Uncertainty

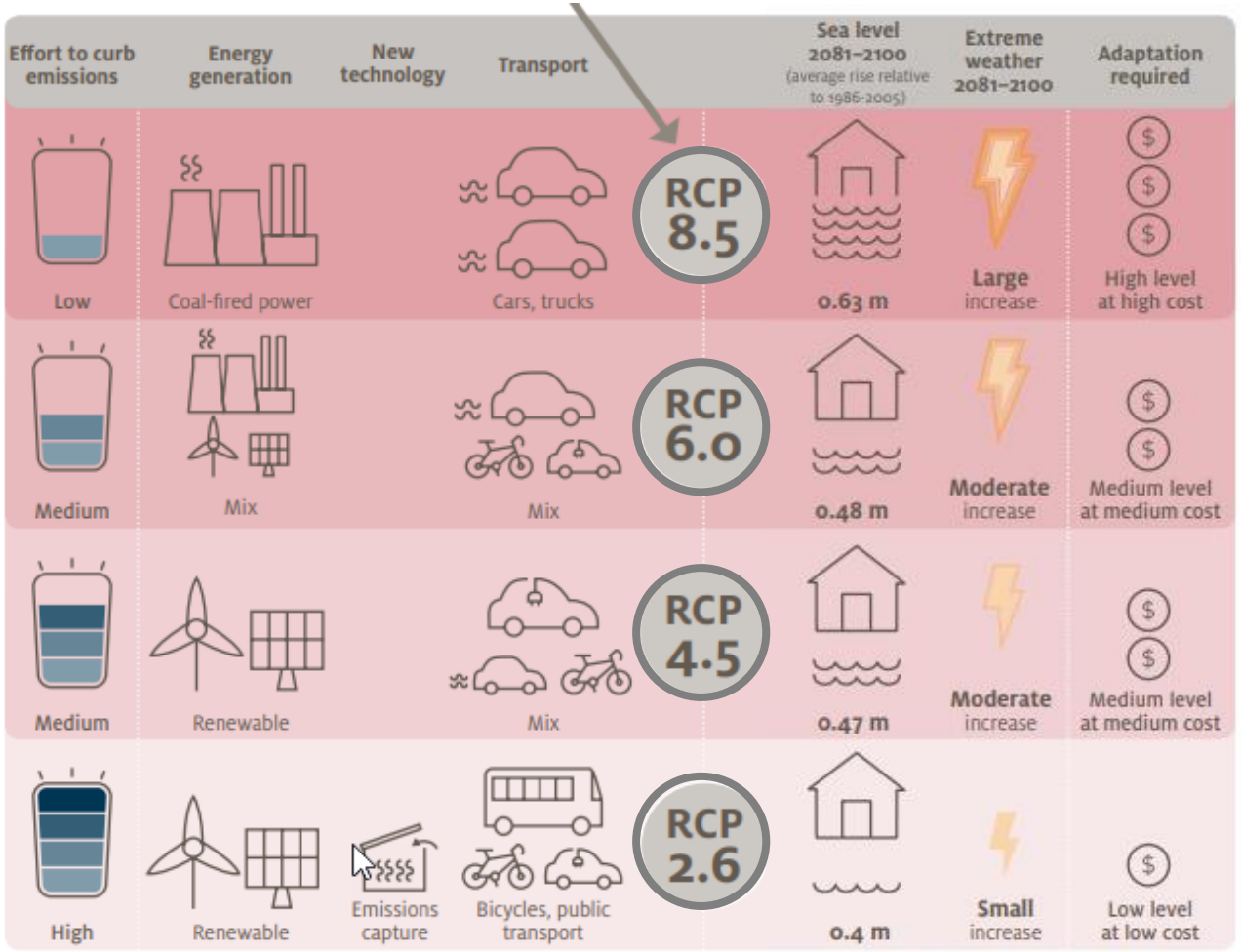
**Uncertainty between scenarios**

Which transition pathway will we follow?

**Uncertainty within scenarios**

Within whichever pathway we follow, how will systems and people adapt?

# The Representative Concentration Pathways (RCPs) illustrate the tradeoff decision between mitigation efforts, adaptation costs and impact.




Approx. temperature increase above pre-industrial, by 2100

5 °C

3 °C

2 °C

We are currently tracking close to RCP8.5, which would require **significant health system adaptation**.

Achieving RCP4.5 would limit the worst effects of heat and unlock the health benefits of cleaner air.

15-117-NCCARFINFOGRAPHICS-01-UPLOADED-WEB(27Feb).pdf (coastadapt.com.au)
Latest projections of future climate now available | Copernicus

# A new era of adaptation, but how will human behaviour and choices change?

10-16 July 2022:
510 people in Spain died from heat-related causes

Late July 2022 in Seville, Spain:
The world's first named heatwave

# Zoe

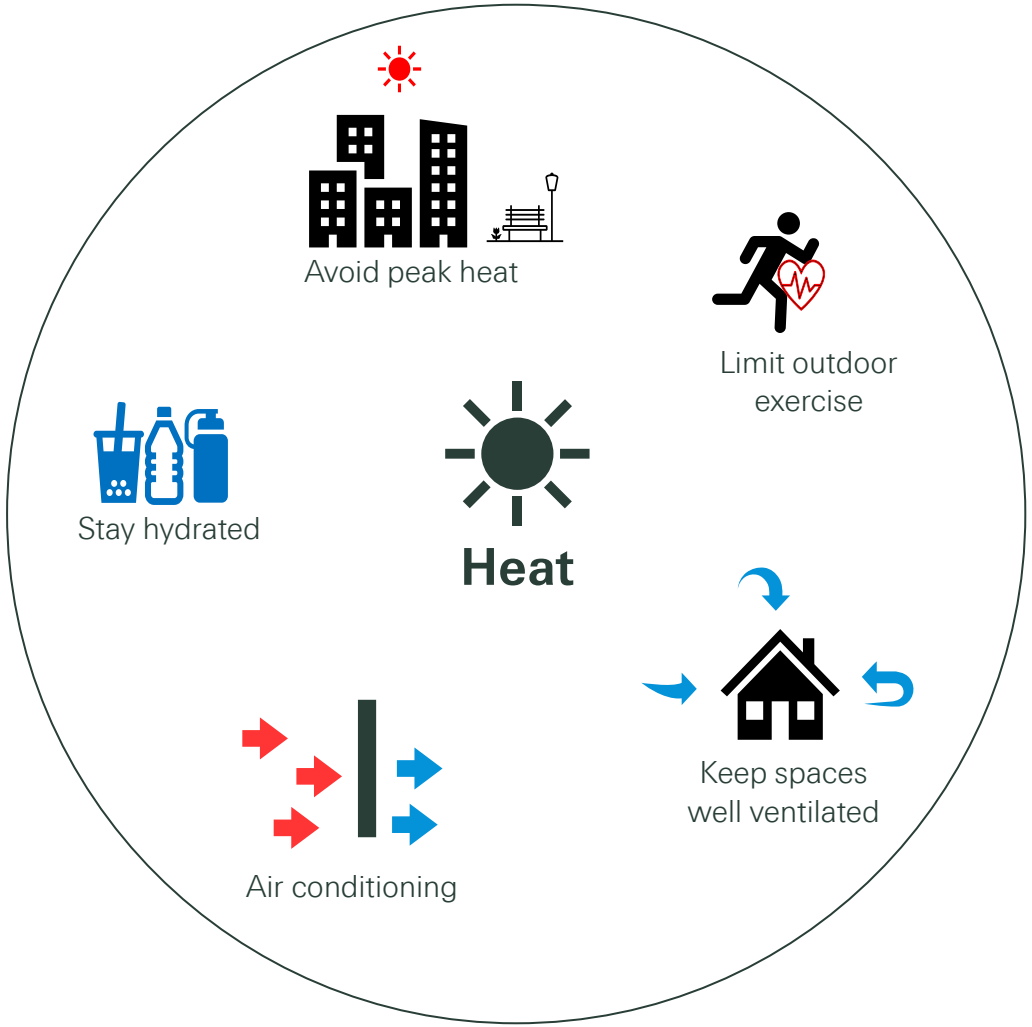
An experiment in behavioural science?

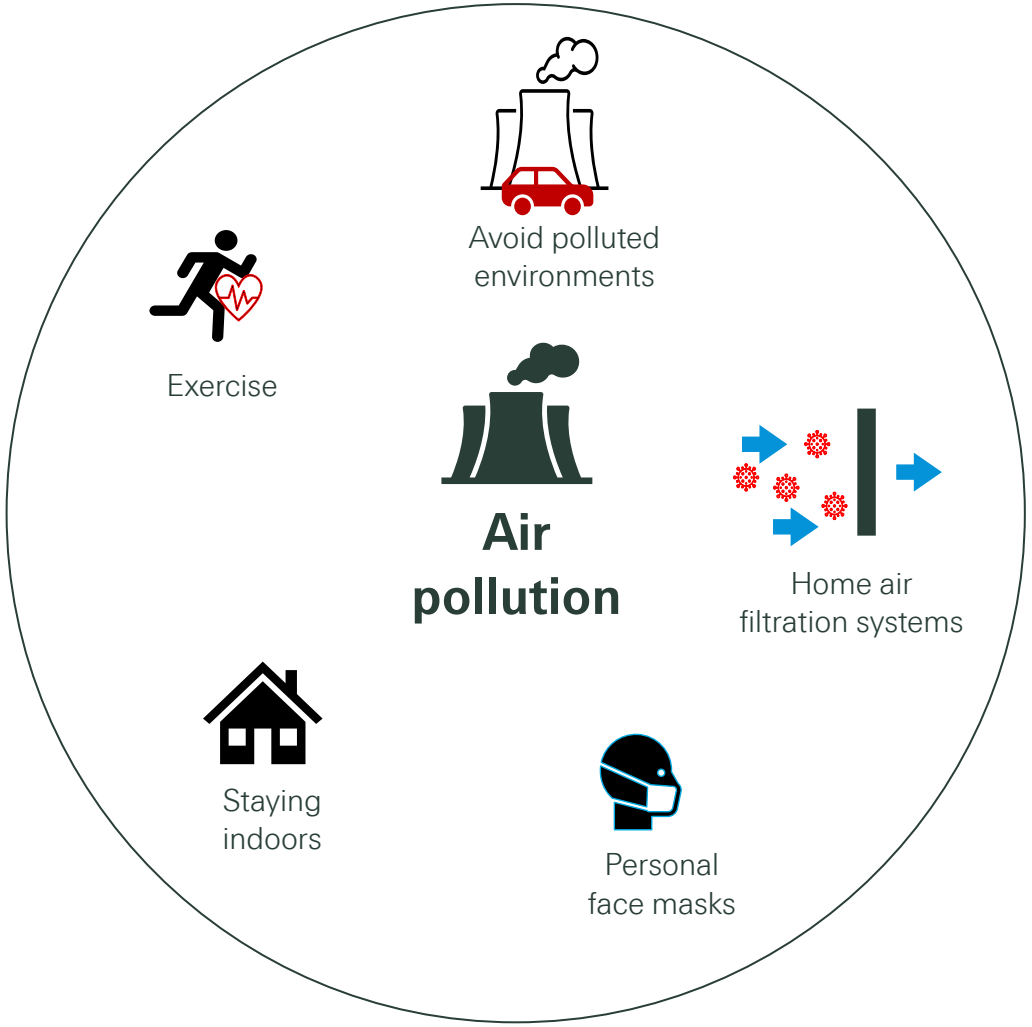
It's going to be hot tomorrow...

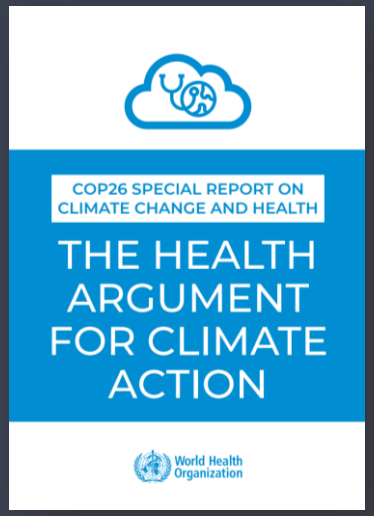
Here comes Heatwave Zoe!

World's First Named Heat Wave, Zoe, Arrives in Seville | Time

# Personal strategies may help to reduce heat and air pollution exposure, but will the resources to do so be widely available?






In a world that embraces the need for reducing carbon emissions, we may live **healthier** and **longer** lives.

The **range of uncertainty** on long-term longevity risk projections is made significantly greater by our changing climate, and how we respond to it.

# Thank you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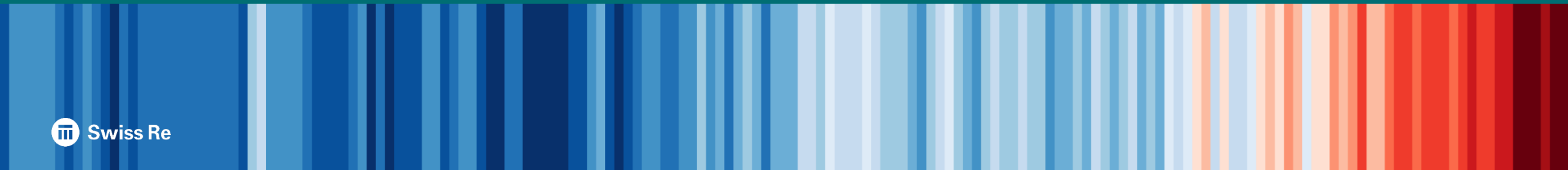
#ShowYourStripes



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