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# Climate Change and Health: Past, Present and Future Impacts

Dr Eunice Lo

30 June 2023

[bristol.ac.uk/cabot](http://bristol.ac.uk/cabot)



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Many minds, one mission

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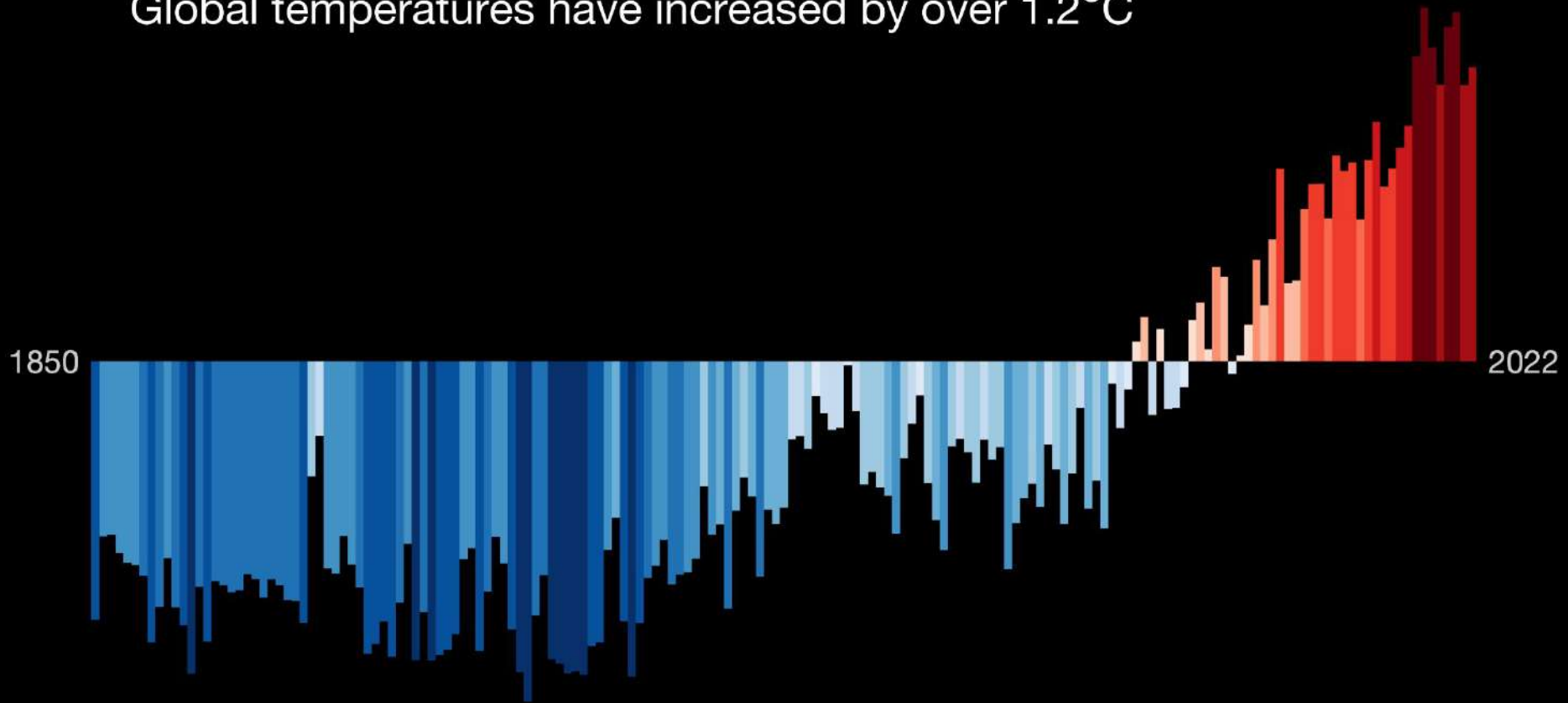


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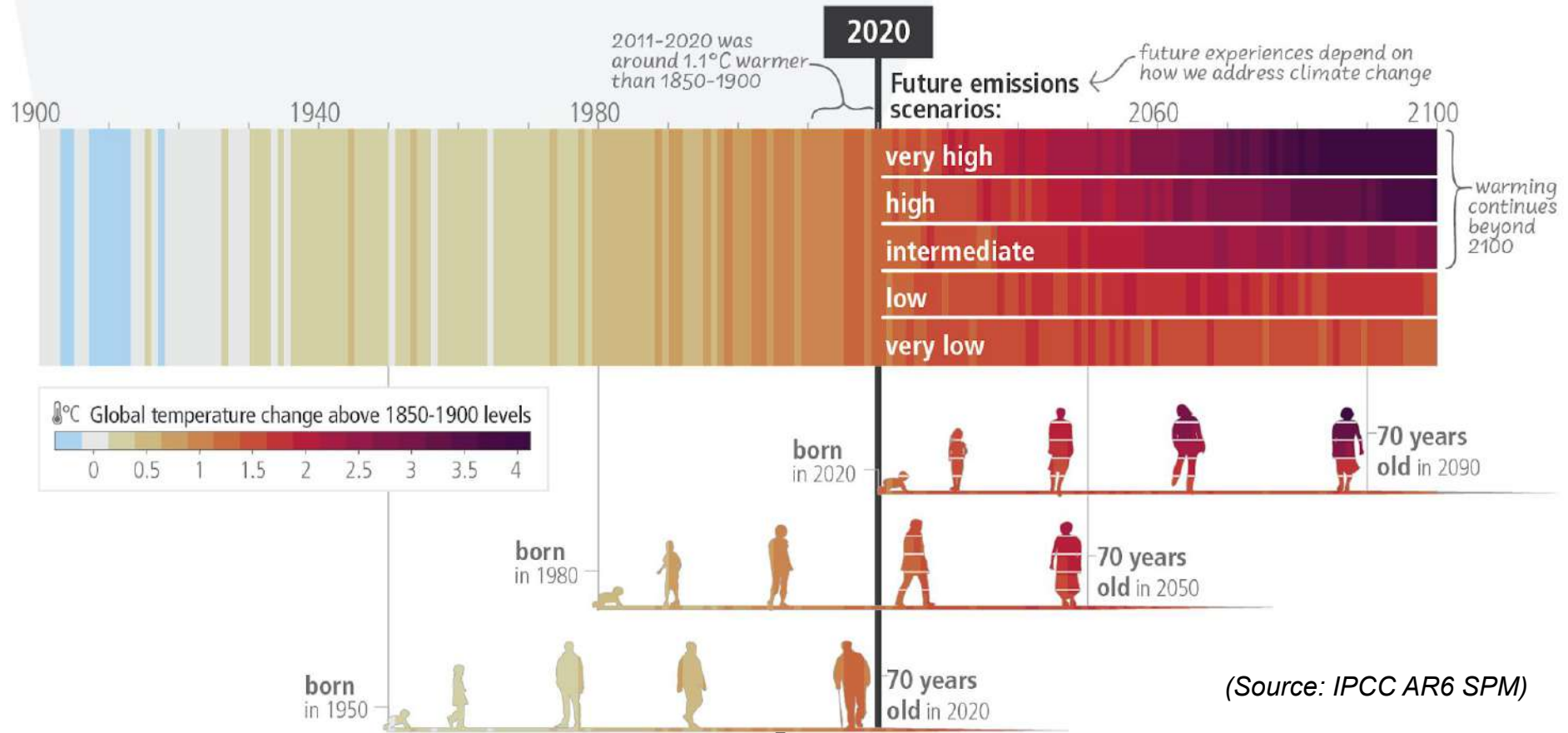
Many minds, one mission

Global temperatures have increased by over 1.2°C



(source: Ed Hawkins, [showyourstripes.info](http://showyourstripes.info))

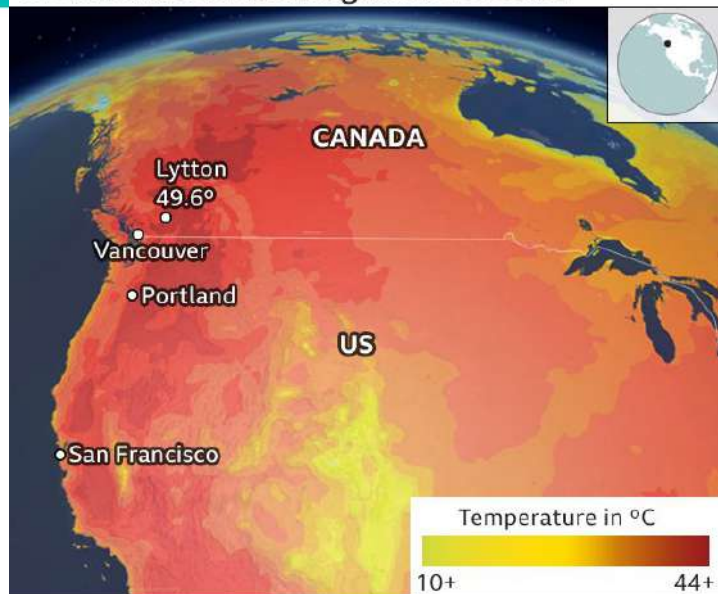
c) The extent to which current and future generations will experience a hotter and different world depends on choices now and in the near-term



(Source: IPCC AR6 SPM)

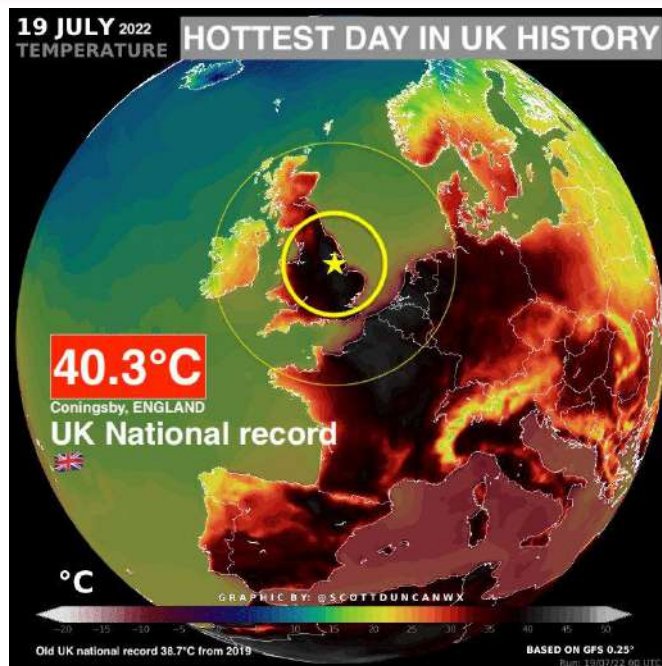
# Record shattering heatwaves

Temperatures in Canada and north-west US reached record highs on 29 June



“Virtually impossible without human-caused climate change” (source: Philip et al., 2022)

“Would have been extremely unlikely without human-caused climate change” (source: WWA 2022)



(source: Scott Duncan)

# Devastating floods and droughts



Flooding in Pakistan affected 33 million people

**“Heavy rainfall made 50-75% more intense because of human-caused climate change”**  
(photo source: Reuters; science source: WWA 2022)

East African drought 2021-2022

**“Low rainfalls in the long rains have become about twice as likely due to human-induced climate change”** (source: WWA 2023)



# Summary about climate change

- Global average temperature has risen by over 1.2°C since pre-industrial times.
- It is because of our greenhouse gas emissions.
- Extreme weather events are made more likely and/or intense because of climate change.
- Everyone is affected by it.





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# Climate change

(Source: WHO)

## Vulnerability

### Vulnerability factors

- Demographic factors
- Geographic factors
- Biological factors & health status
- Sociopolitical conditions
- Socioeconomic factors

### Exposure pathways

- Extreme weather events
- Heat stress
- Air quality
- Water quality and quantity
- Food security and safety
- Vector distribution & ecology

### Health system capacity & resilience

- Leadership & governance
- Health workforce
- Health information systems
- Essential medical products & technologies
- Service delivery
- Financing

## Climate-sensitive health risks

### Health outcomes



Injury and mortality from extreme weather events



Heat-related illness



Respiratory illness



Water-borne diseases and other water-related health impacts



Zoonoses



Vector-borne diseases



Malnutrition and food-borne diseases



Noncommunicable diseases (NCDs)



Mental and psychosocial health

### Health systems & facilities outcomes



Impacts on healthcare facilities



Effects on health systems

# World Health Organization:

“Climate change is the single biggest health threat facing humanity.”

“Between 2030 and 2050, climate change is expected to cause approximately 250,000 additional deaths per year, from malnutrition, malaria, diarrhoea and heat stress.”



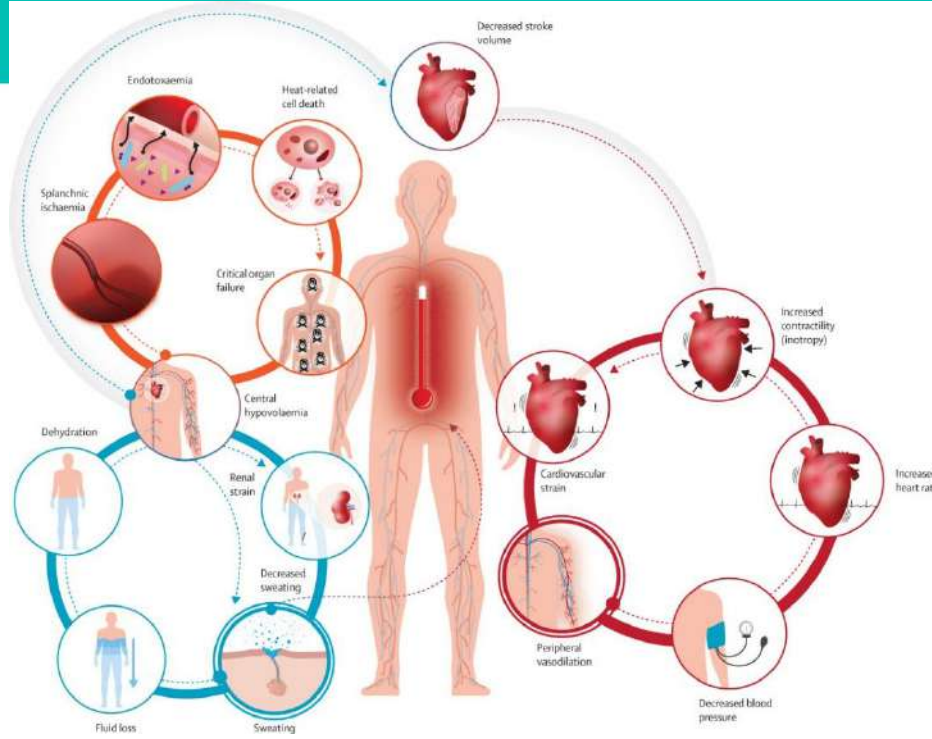
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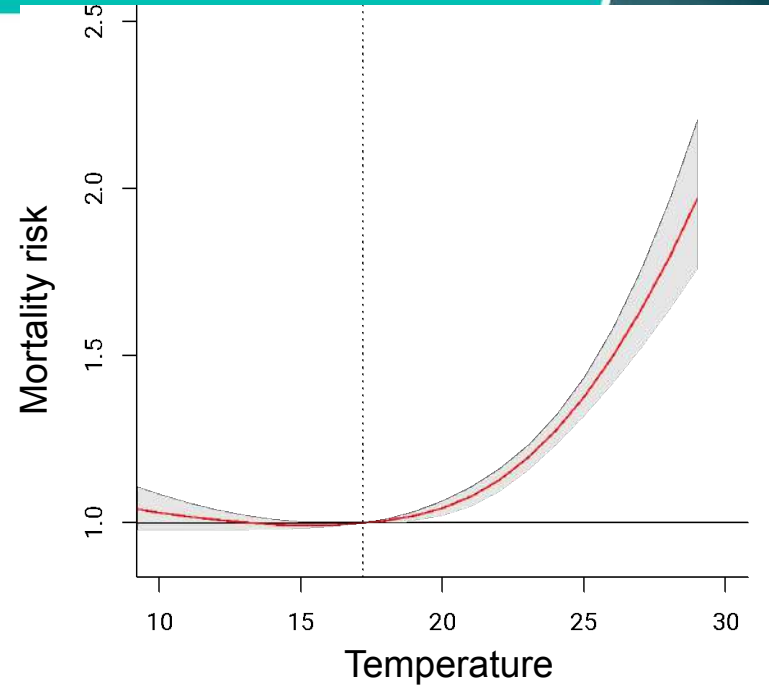


# Heat and health



(Source: Ebi et al., *The Lancet*, 2021)

London



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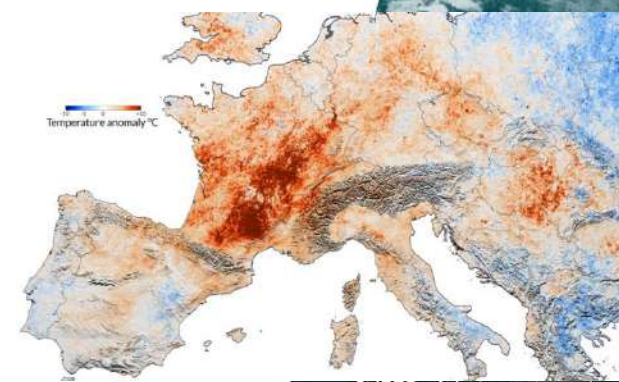
# Heat and health

When	Where	No. of deaths
1995	Chicago	514–778
2003	Europe	20,000
2010	Russia	56,000
1998–2017	Worldwide	166,000
2022	UK	3,000–4,000

England death toll: 2,243 (source: *Public Health England*)  
In 2004 Heatwave Plan for England was introduced.

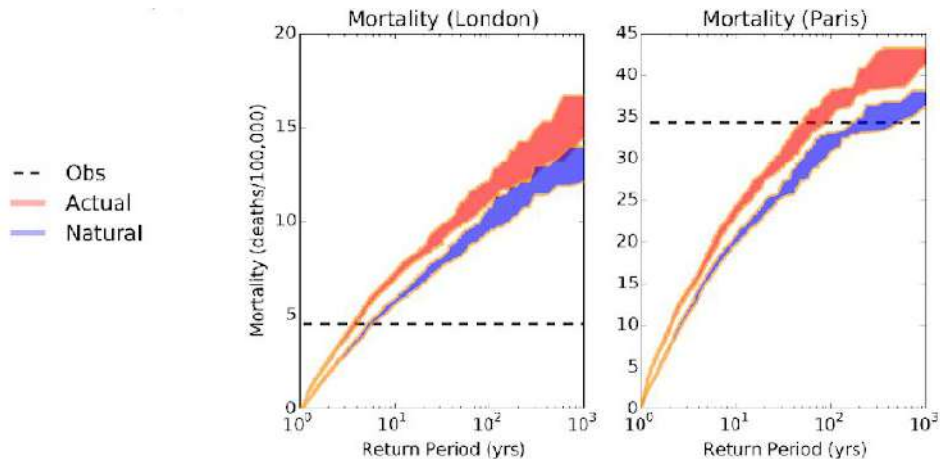


(Source: *Chicago Tribune*)



# 2003 European heatwave impact attribution

- Human influence at least **doubled** the chances of the 2003 European heatwave (*Stott et al., 2004*).
- Human-induced climate change **increased the risk of heat-related mortality in Central Paris by 70% and in London by 20%** (*Mitchell et al., 2016*).

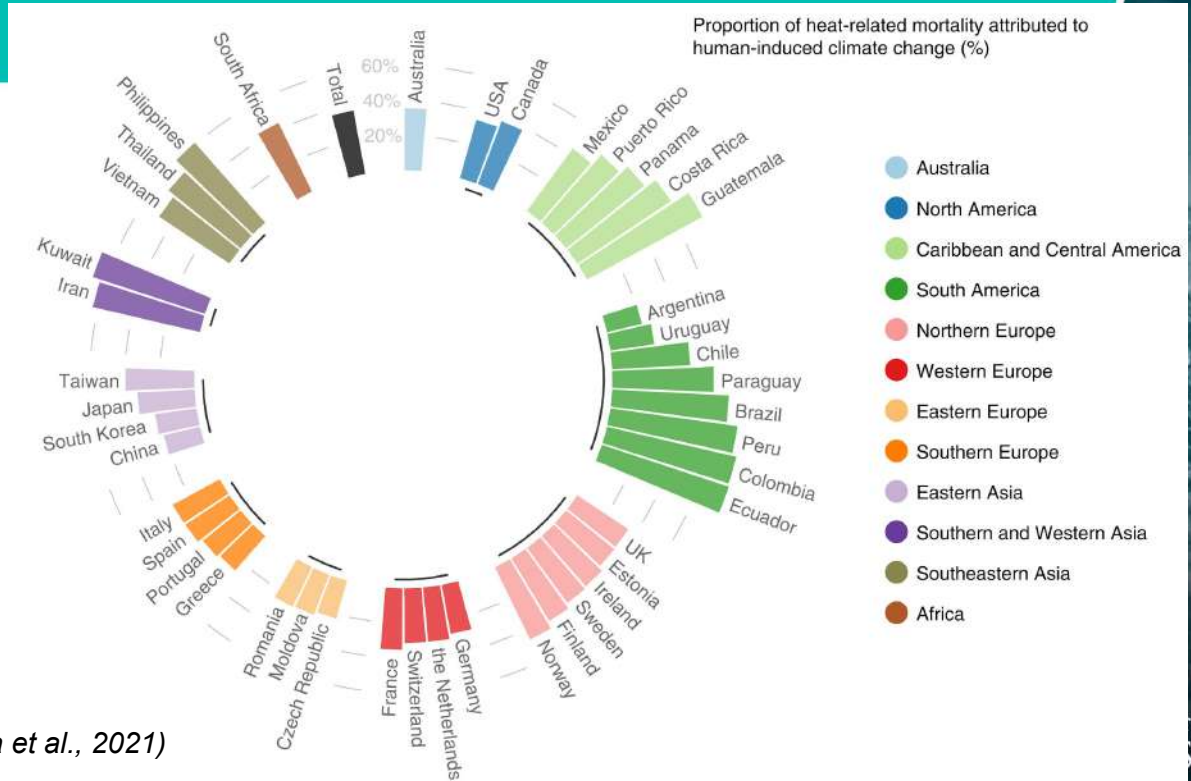




# Global heat-mortality attribution

**In 1991-2018, 37% of warm season heat-related mortality is attributed to human-induced climate change.**

(Source: Vicedo-Cabrera et al., 2021)



# Summary about climate and health

- There are many pathways through which climate change affects human physical and mental health.
- Heatwaves can have high death tolls.
- Both the heatwaves themselves and their health impacts have been attributed to human-induced climate change.



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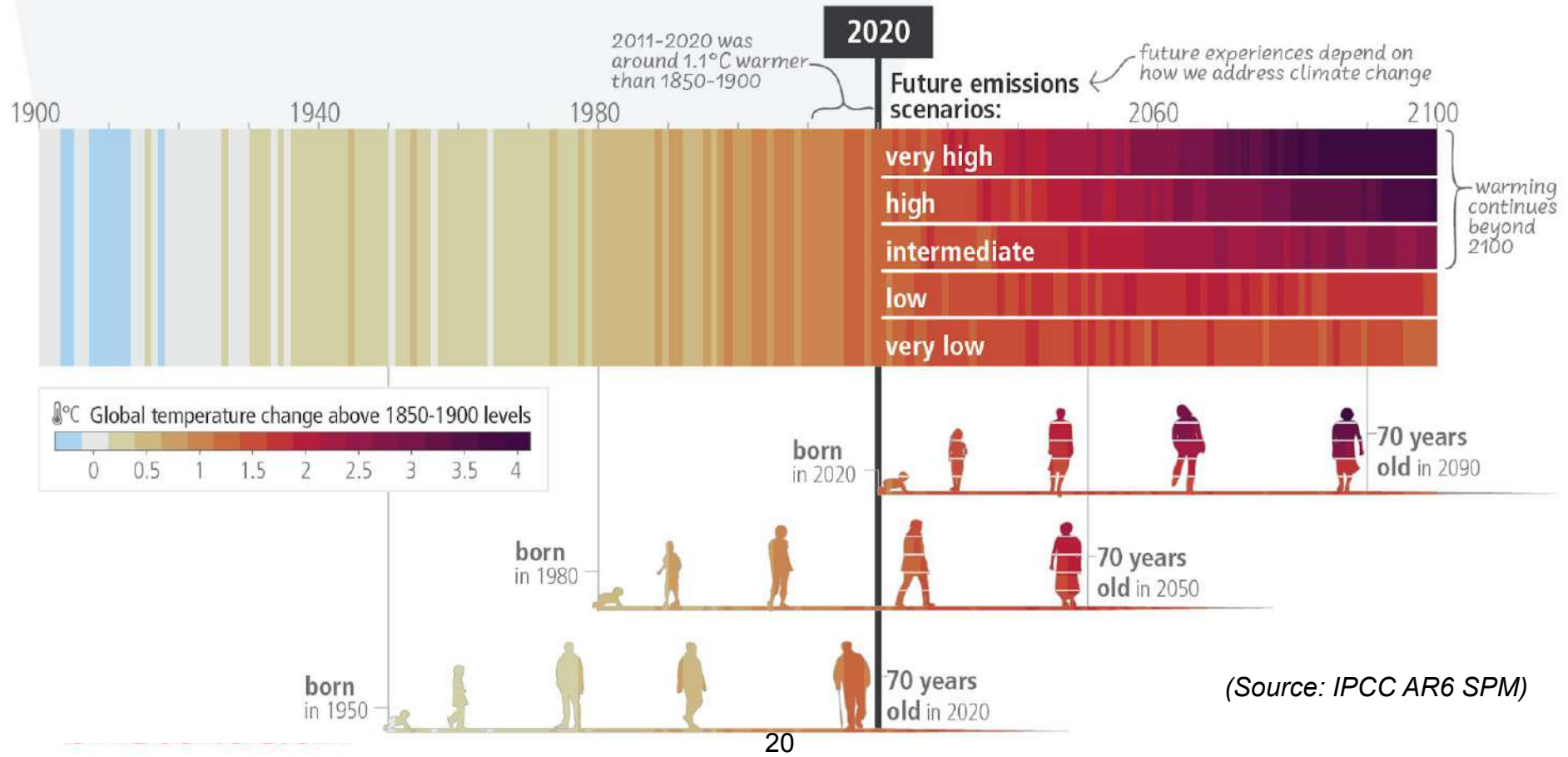


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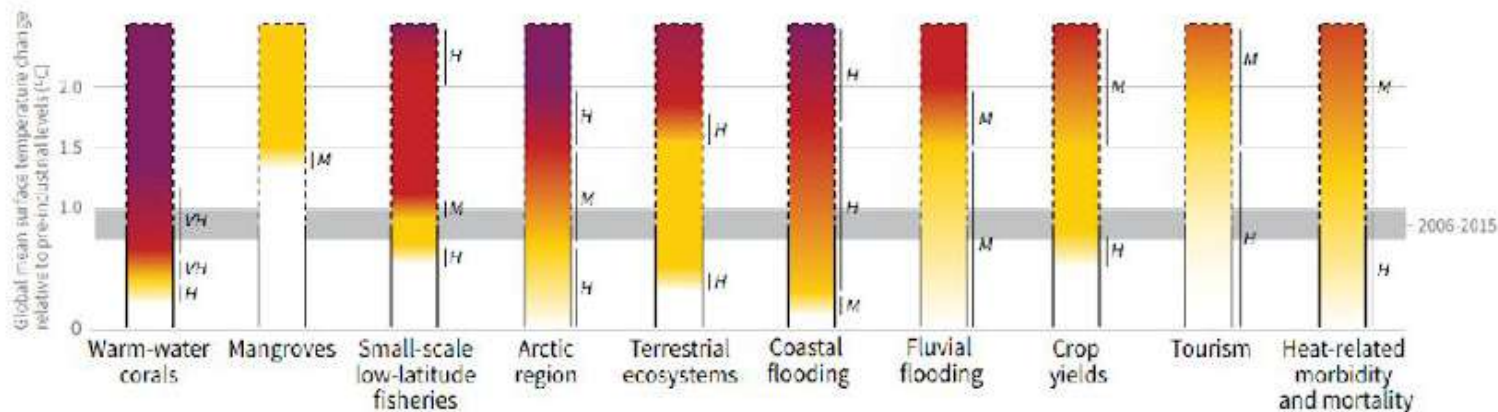
c) The extent to which current and future generations will experience a hotter and different world depends on choices now and in the near-term



# The Paris Agreement

“Keep a global temperature rise this century well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C”.

## Impacts and risks for selected natural, managed and human systems



(Source: IPCC Special Report on 1.5°C Warming, 2018)

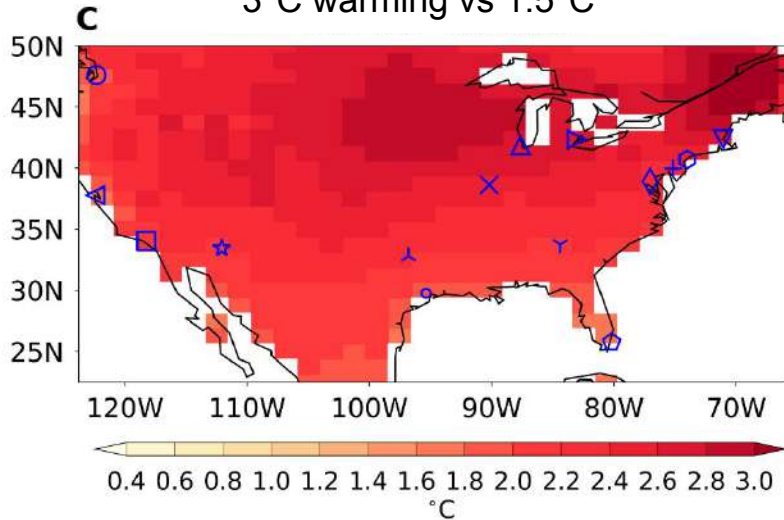
# What this agreement means for heat-health



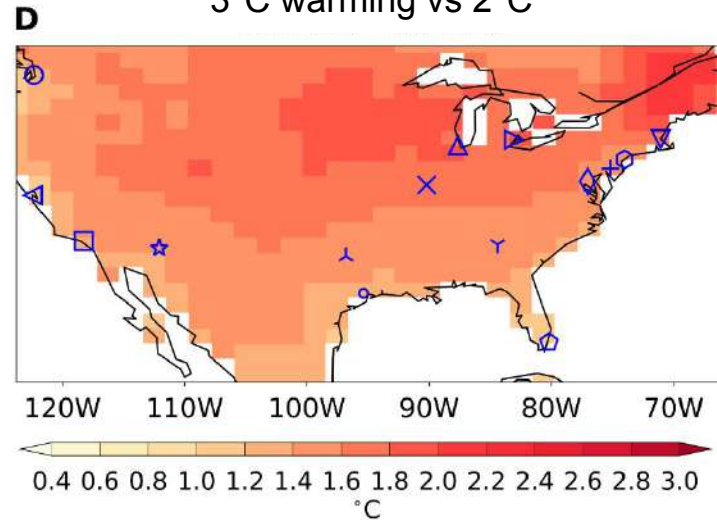
(Source: Lo et al., 2019; Carbon Brief)

# What this agreement means for heat-health

3°C warming vs 1.5°C



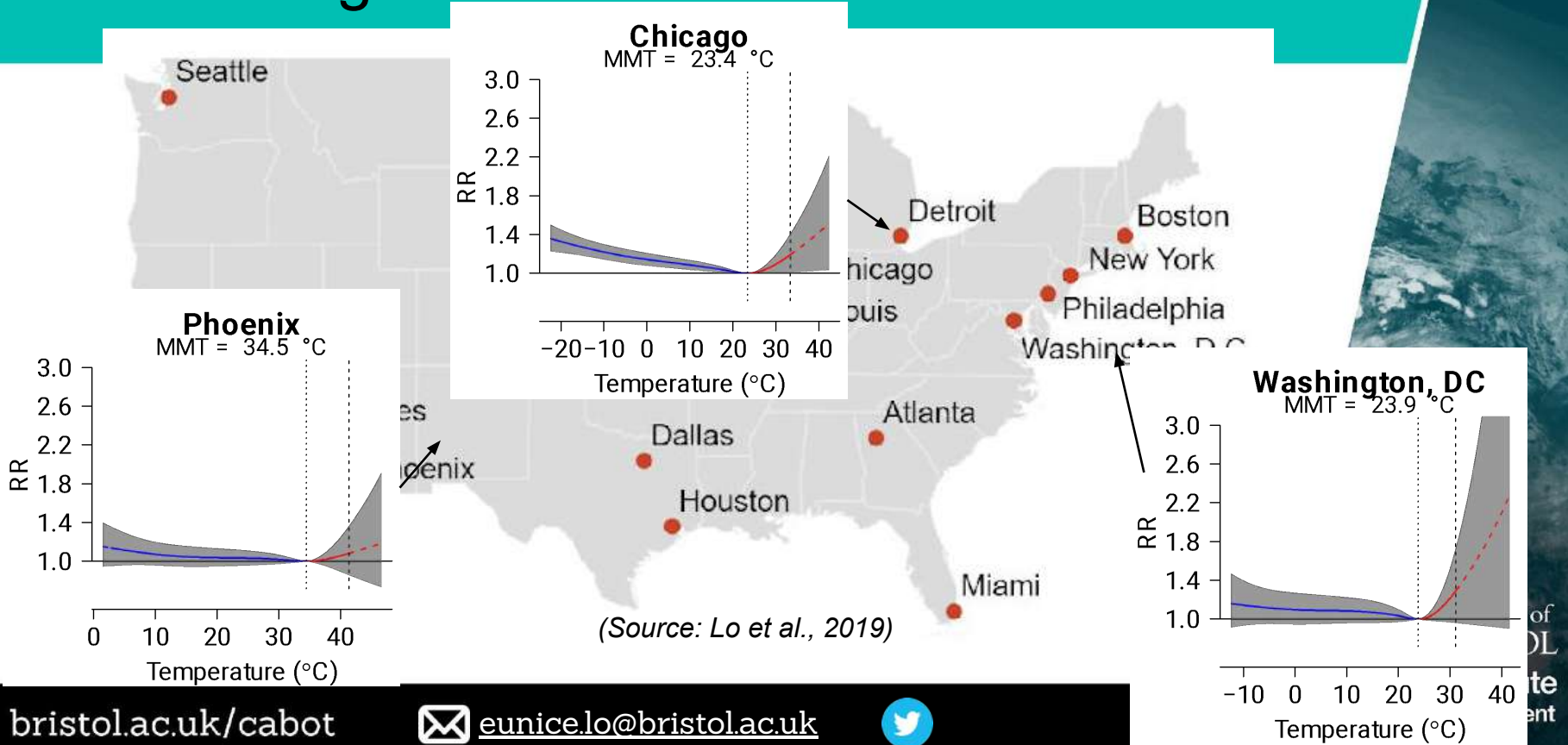
3°C warming vs 2°C



- ▽ Atlanta
- ▽ Boston
- △ Chicago
- △ Dallas
- ▷ Detroit
- Houston
- Los Angeles
- ◇ Miami
- New York
- + Philadelphia
- ★ Phoenix
- △ San Francisco
- Seattle
- × St. Louis
- ◇ Washington, DC

(Source: Lo et al., 2019)

# What this agreement means for heat-health





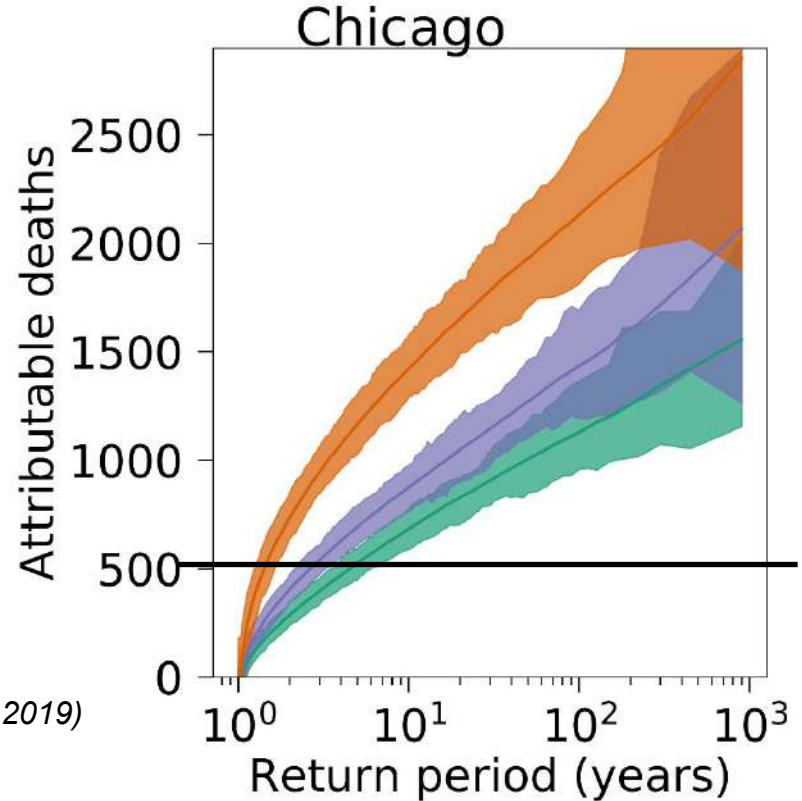
# The 1995 Chicago heatwave

> 514 deaths in 1995

Reoccurrence of this mortality event:

- Every ~1.5 years in 3°C warming
- Every ~ 3 years in 2°C warming
- Every ~ 5 years in 1.5°C warming

(Source: Lo et al., 2019)

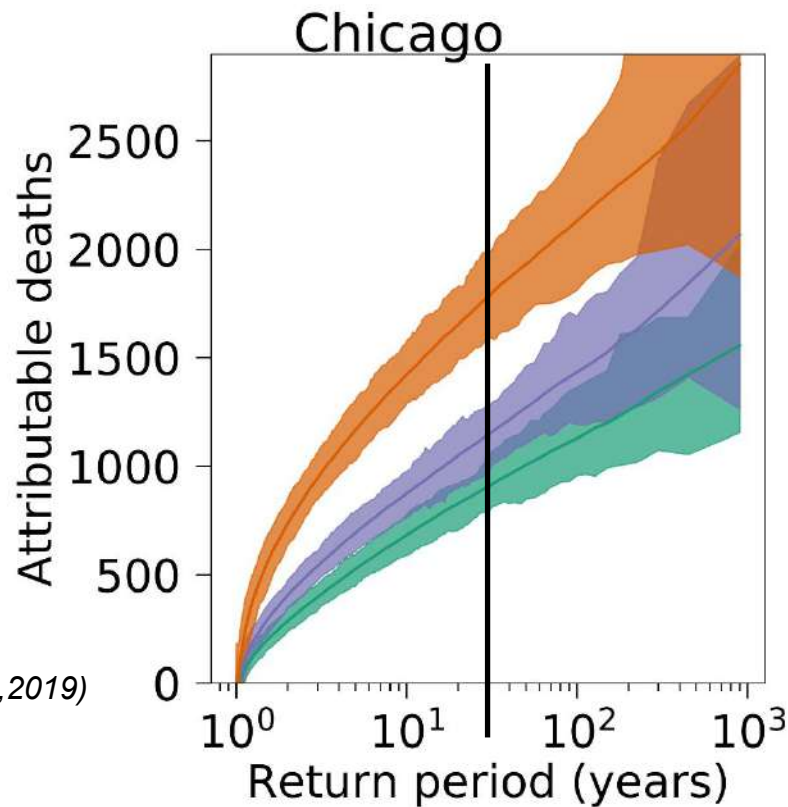


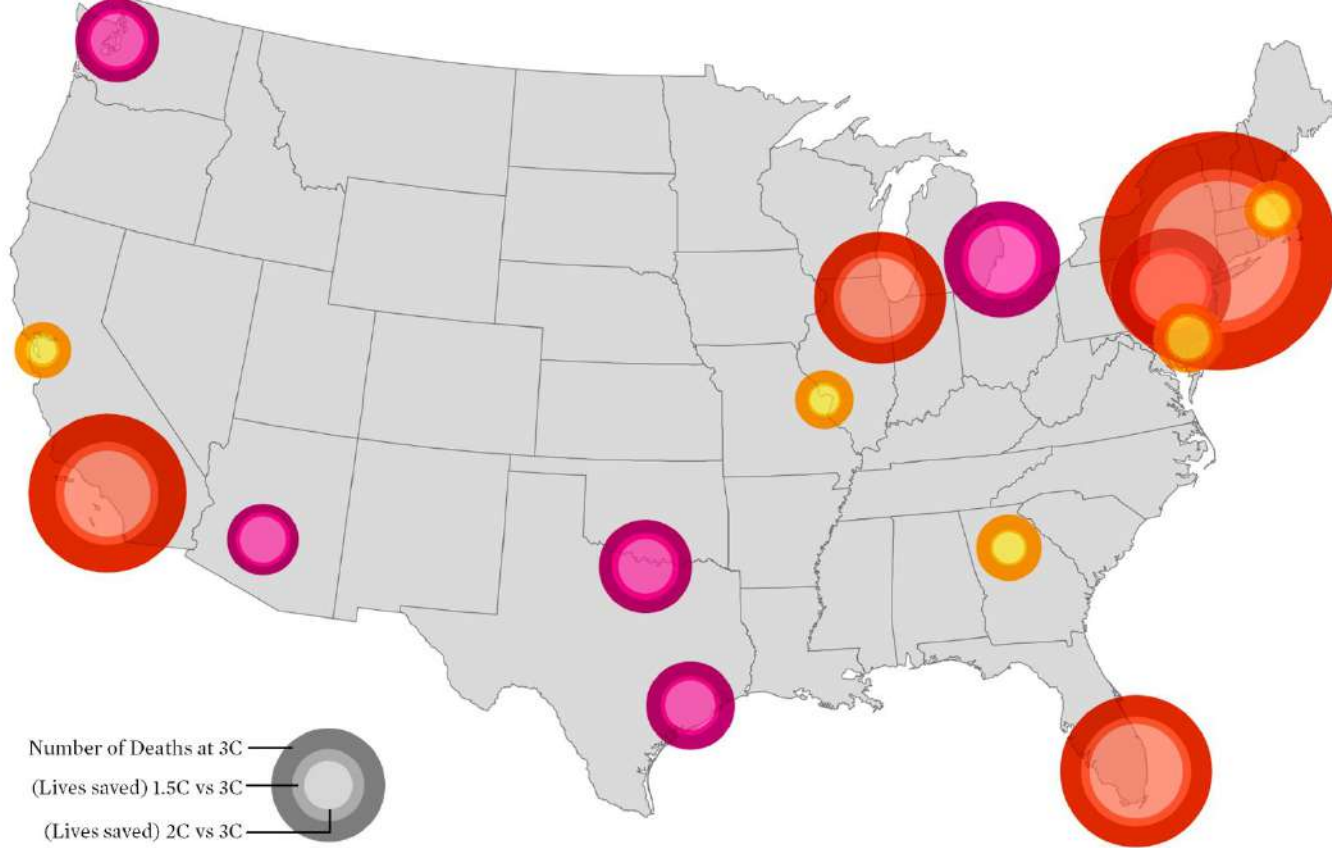
# 1-in-30-year mortality

Annual number of people dying from heat where that year is the warmest in 30 years

- 1781 deaths in 3°C warming
- 1145 deaths in 2°C warming
- 906 deaths in 1.5°C warming
- Chicago population: 2.7M

(Source: Lo et al., 2019)





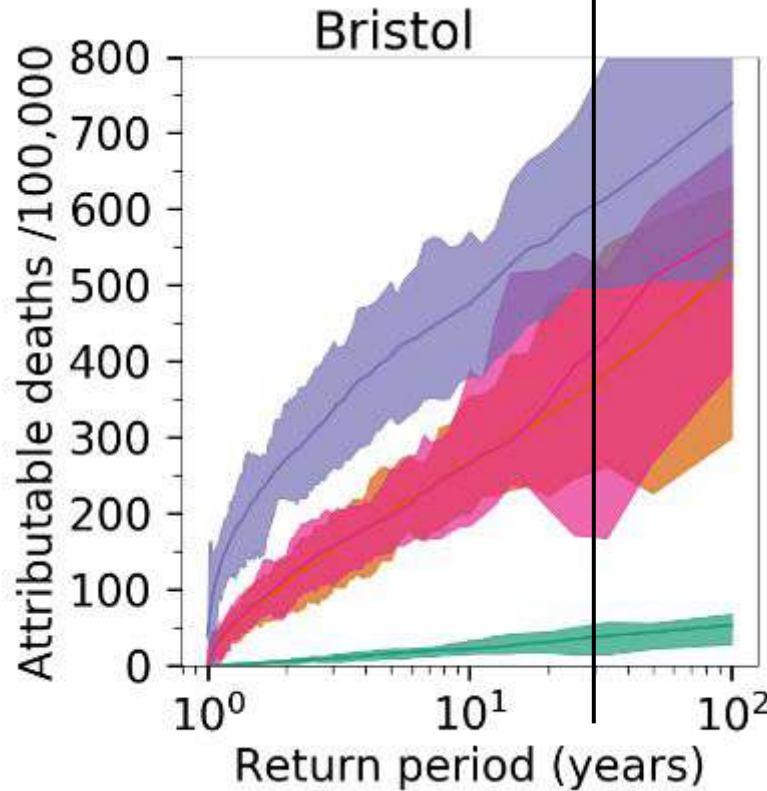
(Source: Lo et al., 2019)

Per City	New York	Los Angeles	Miami	Chicago	Philadelphia
Number of Deaths at 3C	5,798	2,561	2,359	1,781	1,484
(Lives saved) 1.5C vs 3C	2,716	1,085	1,235	875	684
(Lives saved) 2C vs 3C	1,980	759	894	636	500

# What about Bristol?

3°C warming:  
~ 600 deaths per 100,000

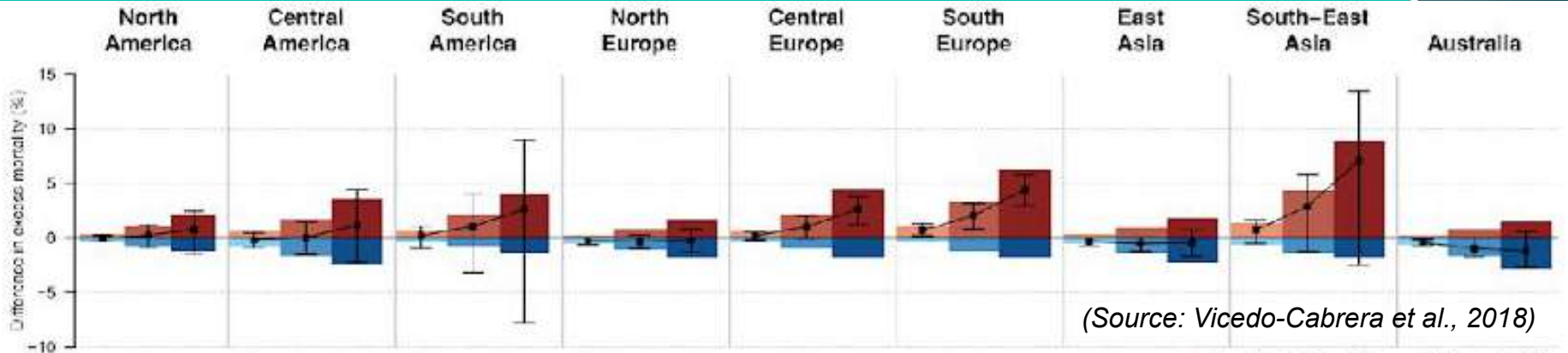
1.5°C warming:  
~ 370 deaths per 100,000



2°C warming:  
~ 410 deaths per 100,000

Historical (2006-2015):  
~ 40 deaths per 100,000

# What about other places?



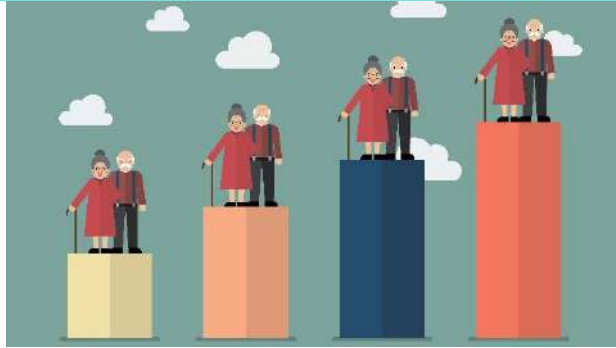
(Source: Vicedo-Cabrera et al., 2018)

- Substantial rise in heat-related mortality due to global mean warming in all studied regions
- Assumption: no changes in demographic distribution and vulnerability

■ Heat-EM - Scen. 2C vs 1.5C  
■ Heat-EM - Scen. 3C vs 1.5C  
■ Heat-EM - Scen. 4C vs 1.5C  
■ Cold-EM - Scen. 2C vs 1.5C  
■ Cold-EM - Scen. 3C vs 1.5C  
■ Cold-EM - Scen. 4C vs 1.5C  
■ Net-EM [95% CI]

# Factors affecting future heat-health

An aging population



Urbanisation



Mitigation



Adaptation



# Summary about future climate and health

- The warmer the climate becomes, the more heat-related mortality will occur.
- This will be made even worse in an aging and increasingly urbanised society.
- Adapting to the impacts and reducing greenhouse gas emissions will save lives.
- The future depends on how we act.



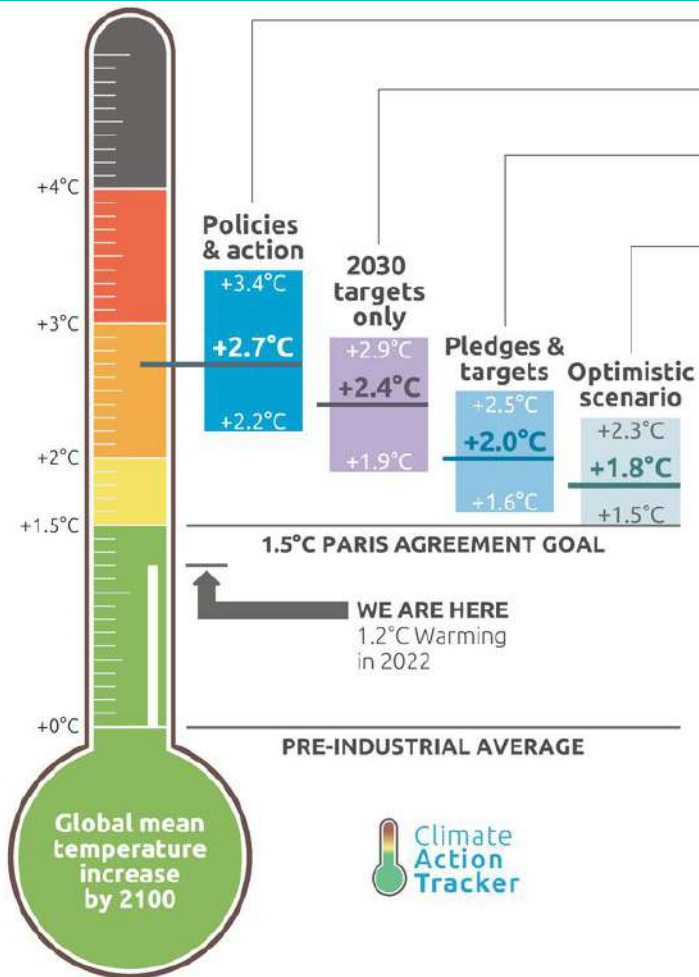
# What future do we want?

<https://climatearchive.org/cop26.html>

*(source: Sebastian Steinig)*







### Policies & action

Real world action based on current policies †

### 2030 targets only

Based on 2030 NDC targets\* †

### Pledges & targets

Based on 2030 NDC targets\* and submitted and binding long-term targets

### Optimistic scenario

Best case scenario and assumes full implementation of all **announced** targets including net zero targets, LTSs and NDCs\*

† Temperatures continue to rise after 2100

\* If 2030 NDC targets are weaker than projected emissions levels under policies & action, we use levels from policy & action

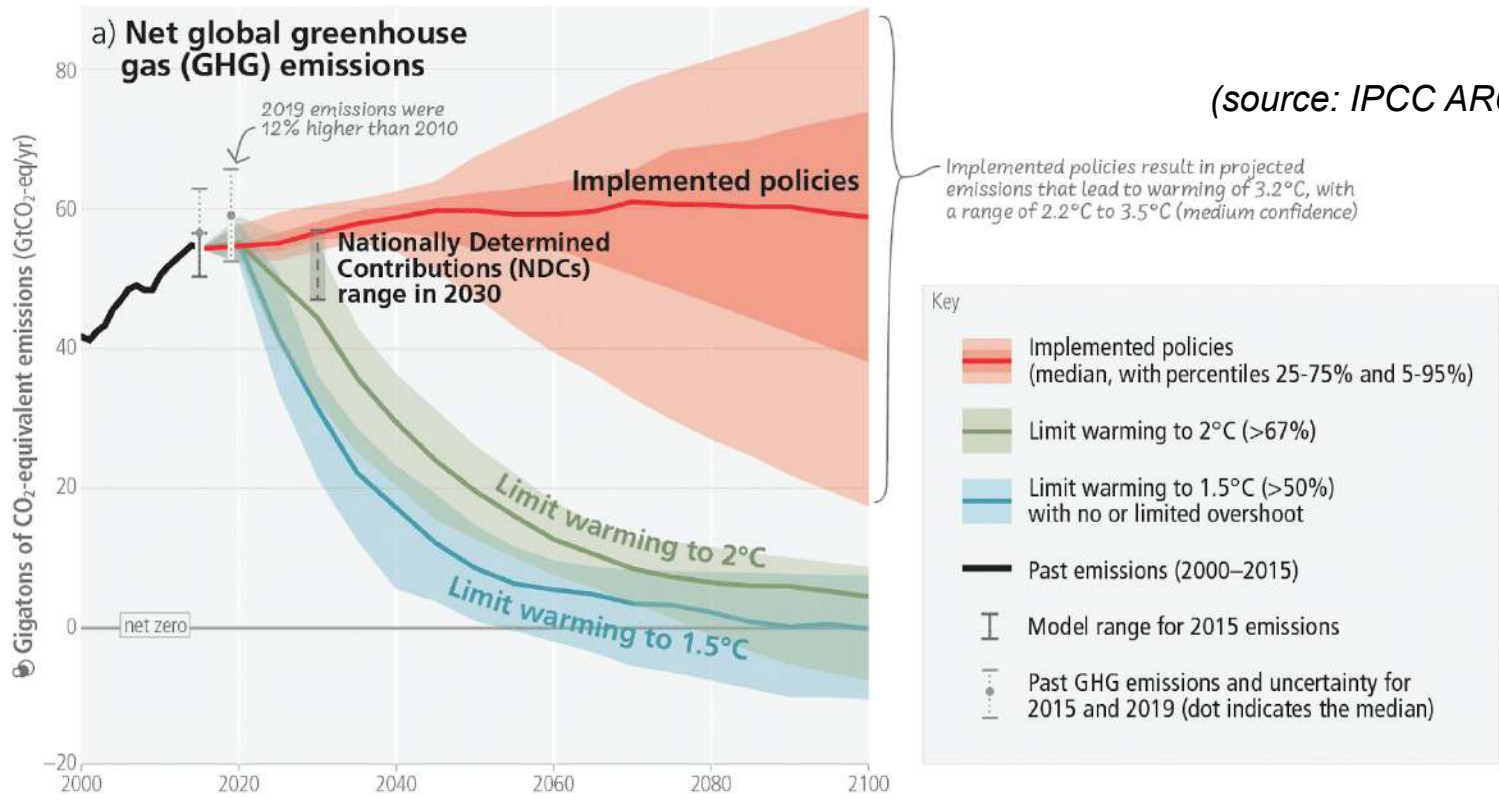
## CAT warming projections Global temperature increase by 2100

November 2022 Update



# Limiting warming to 1.5°C and 2°C involves rapid, deep and in most cases immediate greenhouse emission reductions

Net zero CO<sub>2</sub> and net zero GHG emissions can be achieved through strong reductions across all sectors



(source: IPCC AR6 SPM)



# How are we doing?

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# Climate Change Committee says UK no longer a world leader

🕒 1 day ago · 💬 Comments

“A lack of urgency”

“Immediate priority actions and policies”

“Retake a clear leadership role internationally”



What future do we want?

