La Green Team et le Crash reçoivent

Lana Whittaker
Maîtresse de conférences Changement Climatique et Santé et directrice de recherche au Urban SHADE (Strengthening Health Access and Delivery in Extreme weather events in urban areas) à la Liverpool School of Tropical Medicine.

Kévin Jean
Epidémiologiste, professeur junior Santé et Changements Globaux à l'ENS-PSL, spécialiste de l'évaluation en santé de scénarios de transition énergétique.

Aina Roca Barceló
Spécialiste du soutien à l'adaptation climatique à MSF Humanitarian Action for Climate and the Environment (HACE / MSF-UK).

crash
MÉDECINS SANS FRONTIÈRES
LA FONDATION
CENTRE DE RÉFLEXION SUR L'ACTION ET LES SAVOIRS HUMANITAIRES

JEUDI 6 JUIN 2024

STREAMING ET TRADUCTION (FR/EN)
SUR MSF-CRASH.ORG À 18H30

DEADLY HEATWAVES: WHAT ARE WE TALKING ABOUT ?

Dr Lana Whittaker,
Liverpool School of Tropical Medicine

WHAT IS A HEATWAVE?

In pictures: North India boils as temperatures near 50C

Women use a saree to ward off the heat in Rajasthan state

24 May 2024

Parts of northern India continue to reel under a prolonged heatwave that has thrown normal life out of gear.

On Thursday, temperatures soared beyond 45C in many states and touched 48.8C in Rajasthan state's Barmer city.

India's weather department has said that the heatwave is likely to continue till Wednesday.

Several regions are facing water and electricity shortages due to spikes in

Lethal heatwave in Sahel worsened by fossil fuel burning, study finds

Deaths from record temperatures in Mali reportedly led to full morgues turning away bodies this month

A haycart in northern Mali during the country's 2022 drought. The country recorded its hottest

'Impossible' heatwave struck Philippines in April, scientists find

Human-caused climate crisis brought soaring temperatures across Asia, from Gaza to Delhi to Manila

A man tries to cool himself during hot temperatures in Manila, Philippines, last month. Photograph: Aaron Favila/AP

REGIONAL TRENDS

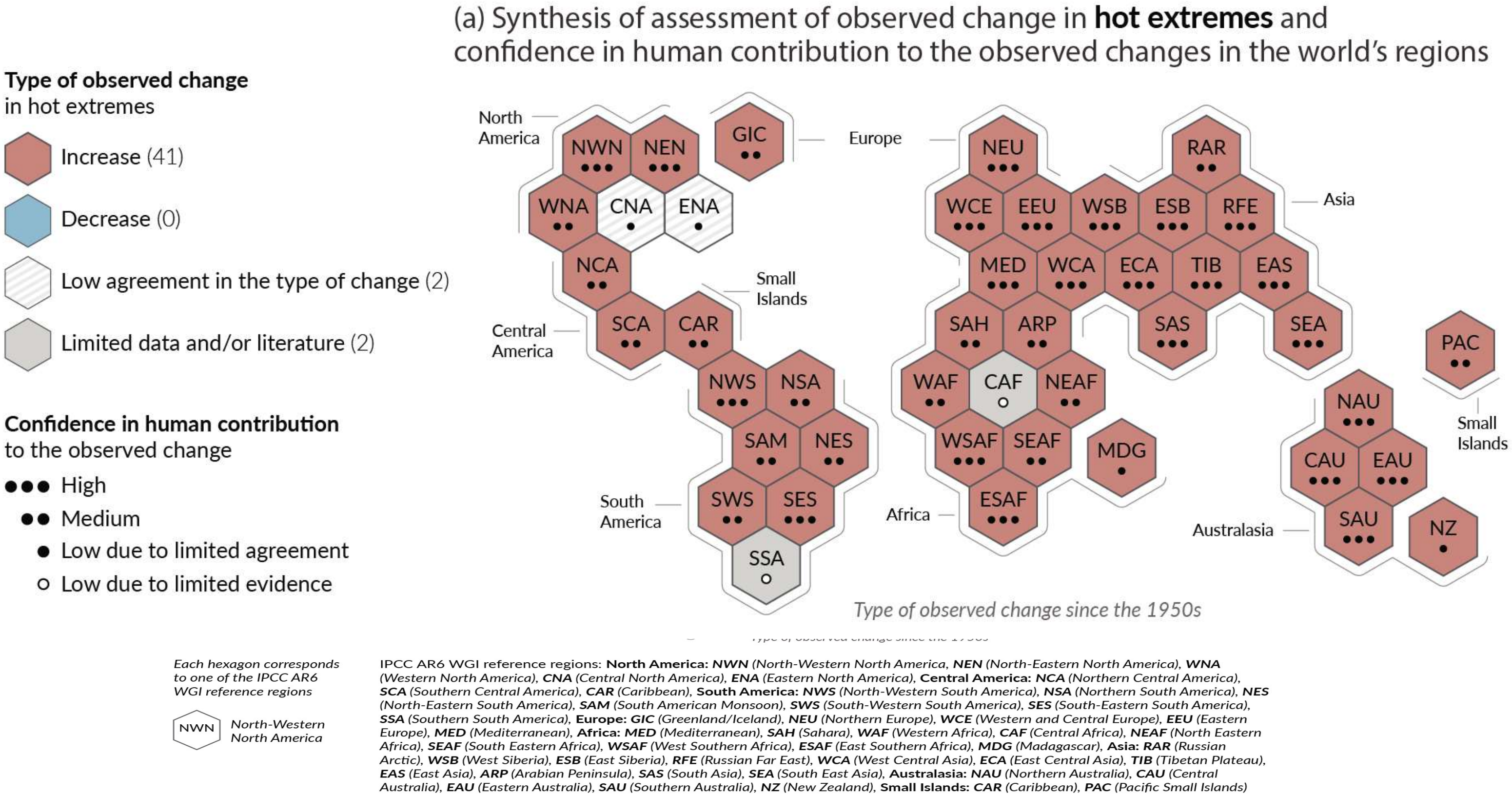
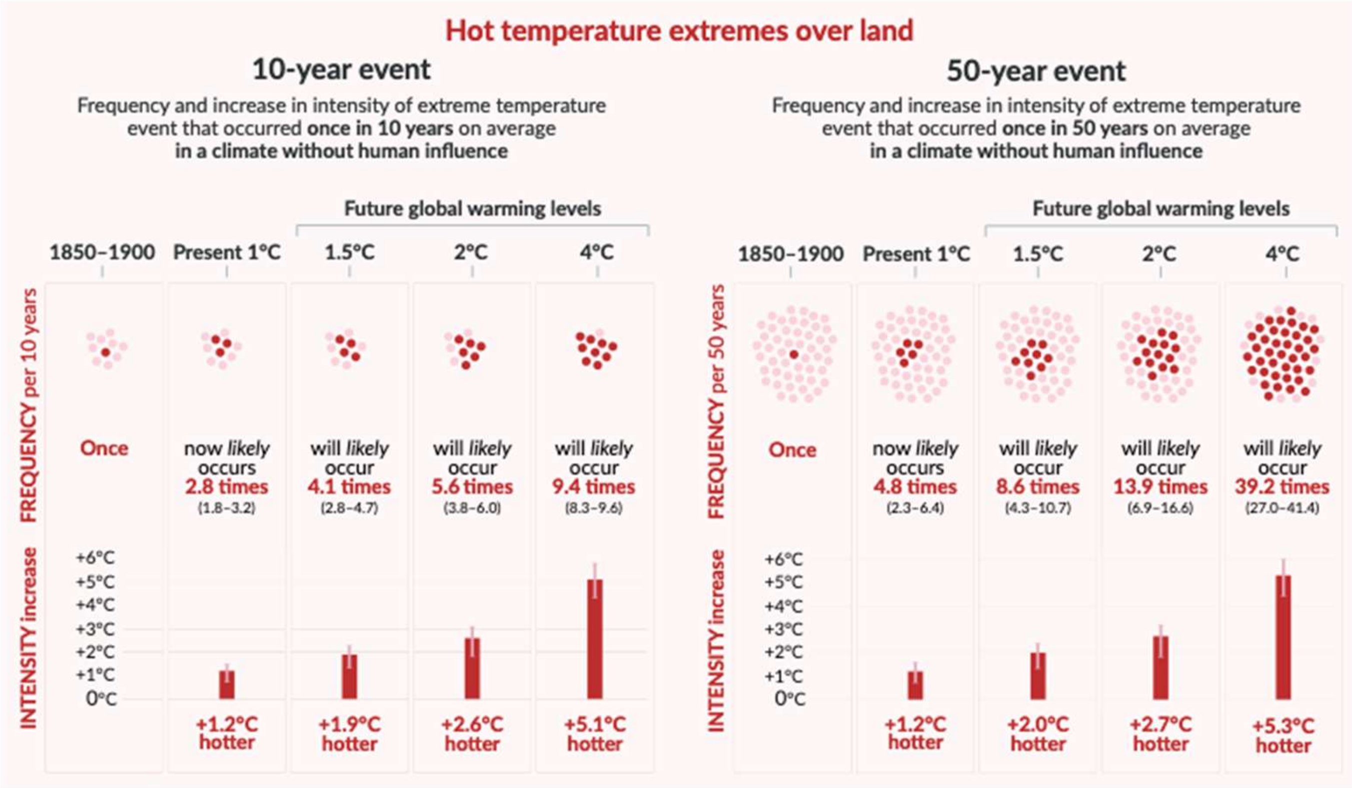


Figure SPM.3 in IPCC, 2021: Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY,USA, pp. 3–32, doi: 10.1017/9781009157896.001 .]

PROJECTIONS



Hot temperature extremes are defined as the daily maximum temperatures over land that were exceeded on average once in a decade (10-year event) or once in 50 years (50-year event) during the 1850–1900 reference period. **Extreme precipitation events** are defined as the daily precipitation amount over land that

Figure SPM.6. IPCC (2021) P18

HEAT INDEX

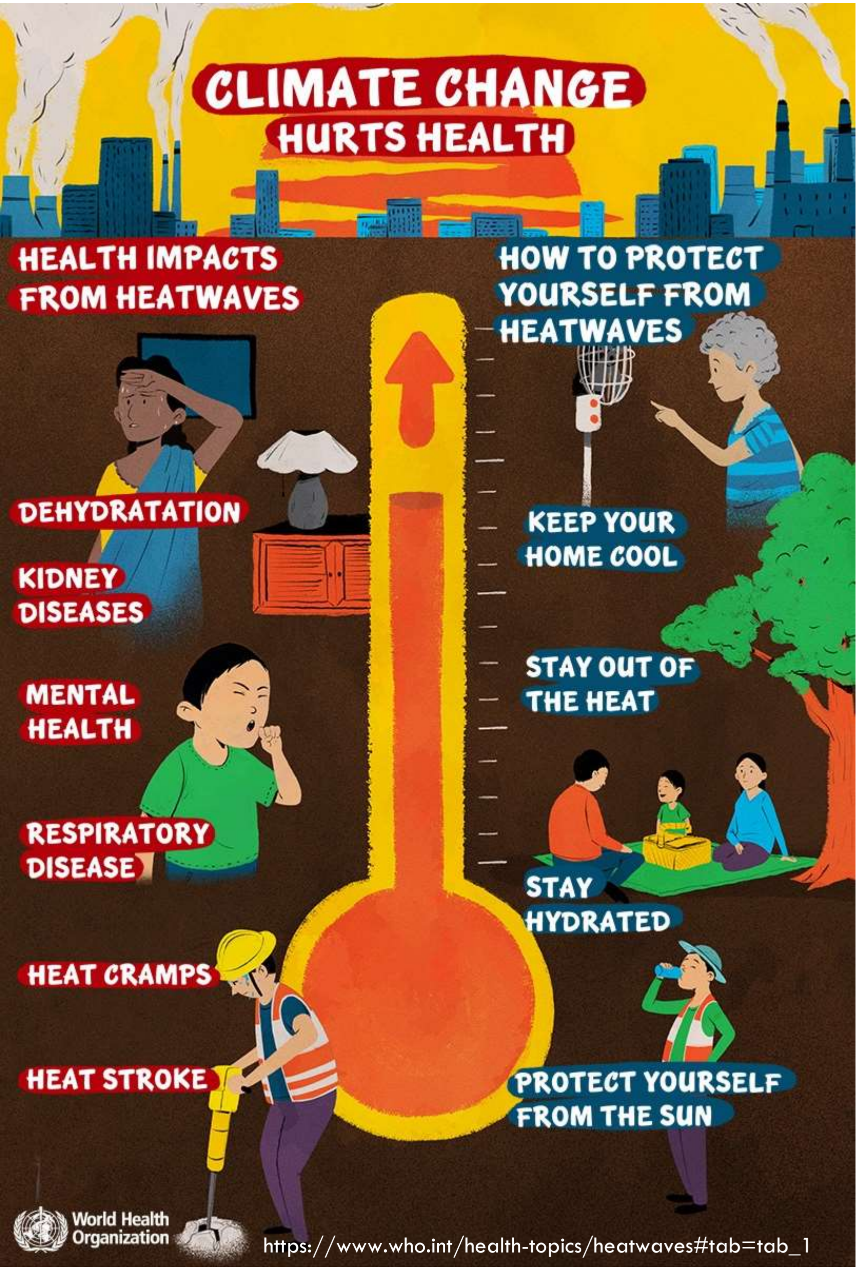
Heat Index: Air temperature and relative humidity

WARNING	HEAT INDEX	HEALTH IMPACT
Safe	< 26	No adverse effects expected due to heat
Caution	27- 32	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	33 - 40	Heat stroke, heat cramps or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	41 - 51	Heat cramps or heat exhaustion likely and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	52 - 92	Heat stroke highly likely
Beyond human threshold*	<93	Values beyond human resistance to heat

RELATIVE HUMIDITY [%]

TEMP [°C]	40	45	50	55	60	65	70	75	80	85	90	95	100
23	22	22	22	23	23	23	23	24	24	24	24	24	25
24	23	23	24	24	24	24	25	25	25	25	25	26	26
25	24	25	25	25	25	25	26	26	26	27	27	27	28
26	25	26	26	26	26	27	27	27	28	28	29	29	30
27	27	27	27	27	28	28	29	29	30	30	31	31	32
28	28	28	28	29	29	30	30	31	32	32	33	34	36
29	29	29	30	30	31	31	32	33	34	35	36	39	48
30	30	31	31	32	32	33	34	35	36	38	43	53	60
31	31	32	33	33	34	35	36	38	39	47	57	61	63
32	33	33	34	35	36	38	39	41	50	59	62	64	67
33	34	35	36	37	39	40	42	53	60	63	65	68	71
34	36	37	38	40	41	43	54	61	63	66	69	72	74
35	37	39	40	42	44	55	61	64	67	70	73	76	78
36	39	41	43	45	55	61	64	67	70	73	77	80	83
37	41	43	45	54	61	64	68	71	74	77	80	84	87
38	43	46	51	61	64	68	71	74	78	81	85	88	91
39	46	49	60	64	67	71	75	78	82	85	89	92	95
40	48	59	63	67	71	74	78	82	86	89	93	96	100
41	54	62	66	70	74	78	82	86	90	93	97	101	105
42	60	65	69	73	78	82	86	90	94	98	102	105	109
43	63	68	72	77	81	85	90	94	98	102	106	110	114
44	66	71	76	80	85	89	94	98	102	107	111	115	119
45	69	74	79	84	89	93	98	102	107	111	116	120	124
46	72	77	82	87	92	97	102	107	111	116	120	125	129
47	75	81	86	91	96	101	106	111	116	121	125	130	134
48	78	84	90	95	100	105	111	116	121	126	130	135	140
49	82	87	93	99	104	110	115	120	125	131	135	140	145
50	85	91	97	103	109	114	120	125	130	136	141	146	151
51	88	95	101	107	113	119	124	130	135	141	146	151	156
52	92	98	105	111	117	123	129	135	140	146	151	157	162

Extended National Weather Service (NWS) Heat Index (Lu and Romps 2022)
https://www.isglobal.org/en/heat-index-calculator



HOW DOES HEAT IMPACT HEALTH?

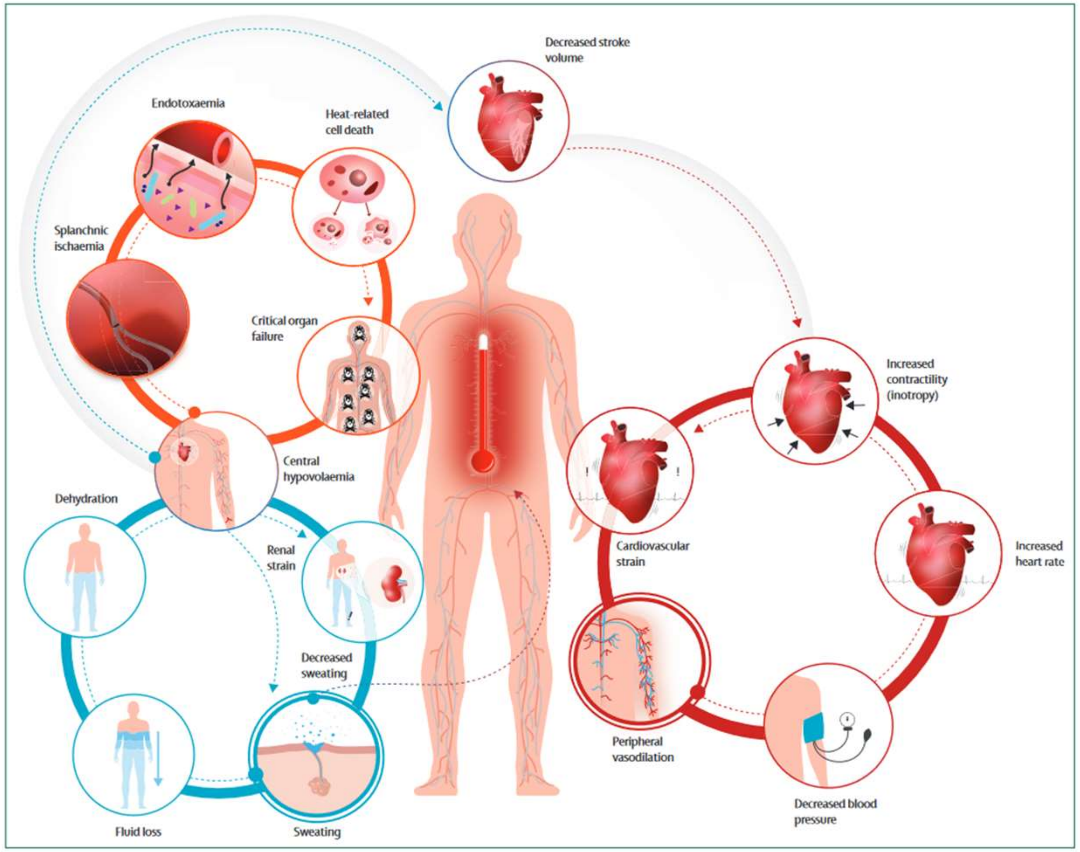


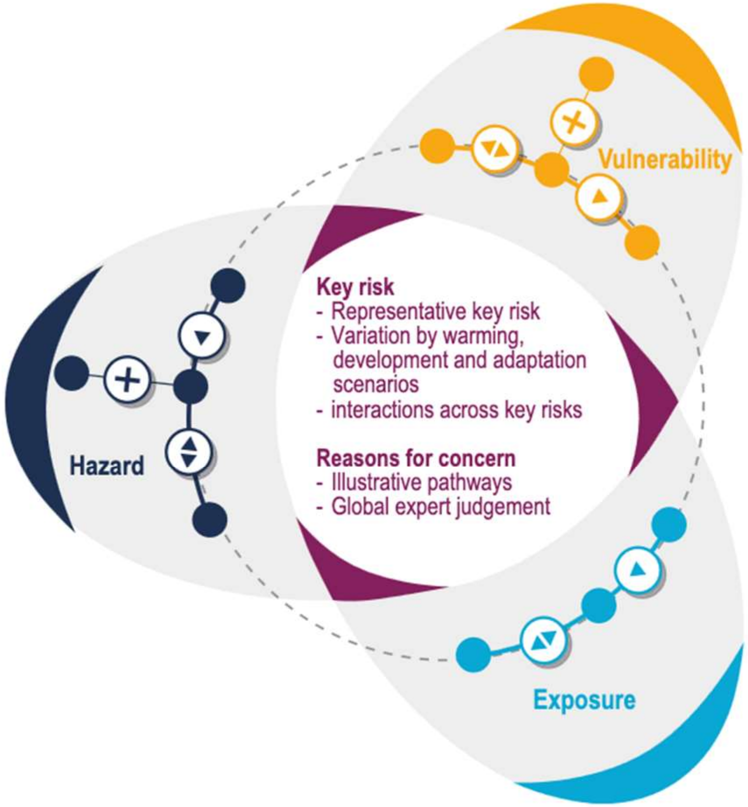
Figure: Illustration of the physiological pathways of human heat strain

Ebi et al., (2021)

COMPOUND EVENTS

Source: ARC, 2024

HOW DO THE IMPACTS OF HEAT ON HEALTH VARY? WHO IS THE MOST VULNERABLE?



IPCC, 2022

ARISE, 2024

Conférence MSF
6 juin 2024

Les vagues de chaleur et leurs impacts de santé publique

Kévin JEAN

Chaire Prof. Junior *Santé et Changements Globaux*

Laboratoire **MESuRS**

kevin.jean@ens.psl.eu

Epidémiologie du lien température - mortalité

Relation température - mortalité

- Mise en lumière par des analyses de séries temporelles
  - Captent un effet de court terme (avec un délai possible)

Table 1 Example rows of time series data from the London dataset showing daily levels of environmental variables and daily number of deaths

Date	Ozone (μg/m^3)	Temperature (°C)	Relative humidity (%)	*n* deaths
1 Jan 2002	4.59	−0.2	75.7	199
2 Jan 2002	4.88	0.1	77.5	231
3 Jan 2002	4.71	0.9	81.3	210
4 Jan 2002	4.14	0.5	85.4	203
5 Jan 2002	2.01	4.3	93.5	224
6 Jan 2002	2.4	7.1	96.4	198
7 Jan 2002	4.08	5.2	93.5	180
8 Jan 2002	3.13	3.5	81.5	188
9 Jan 2002	2.05	3.2	88.3	168
10 Jan 2002	5.19	5.3	85.4	194
11 Jan 2002	3.59	3.0	92.6	223
12 Jan 2002	12.87	4.8	94.2	201

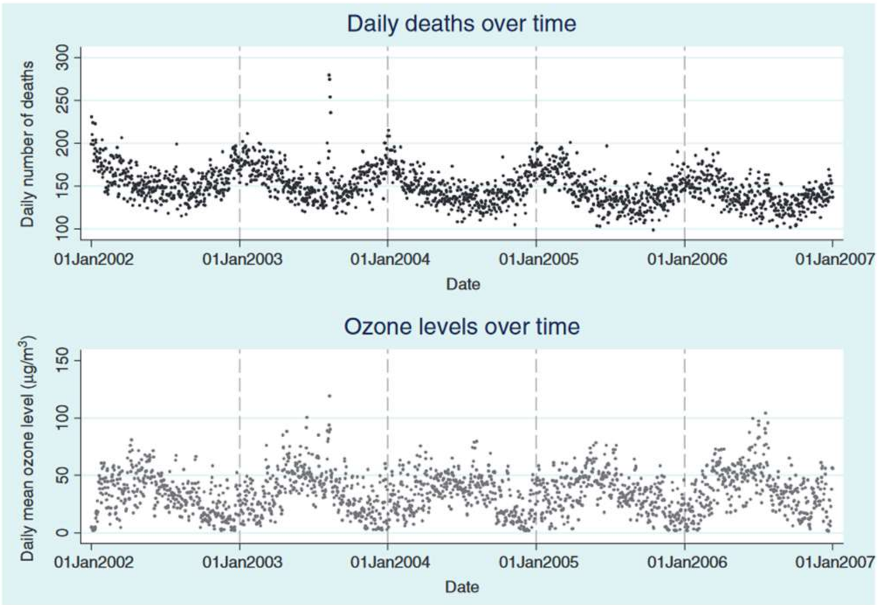
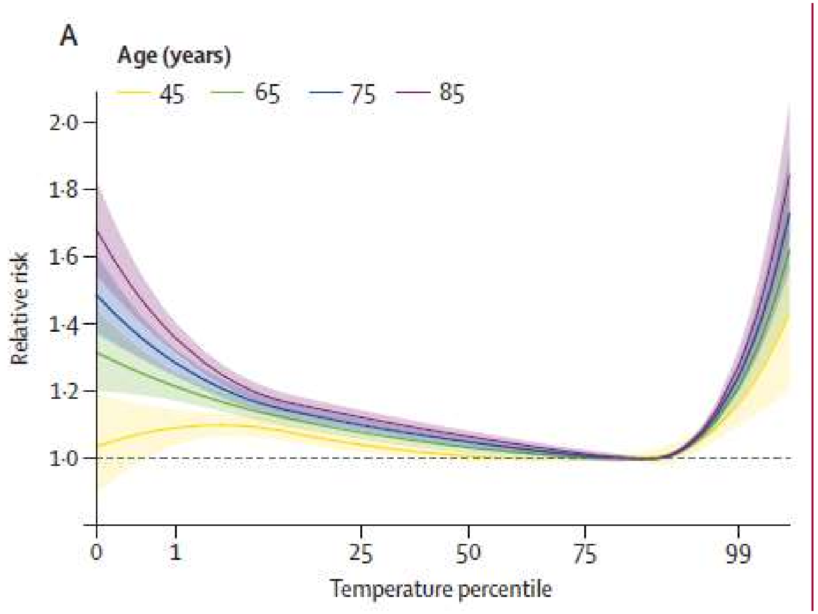


Figure 1 Raw plots showing outcome (deaths) and exposure (ozone) data over time (London data)

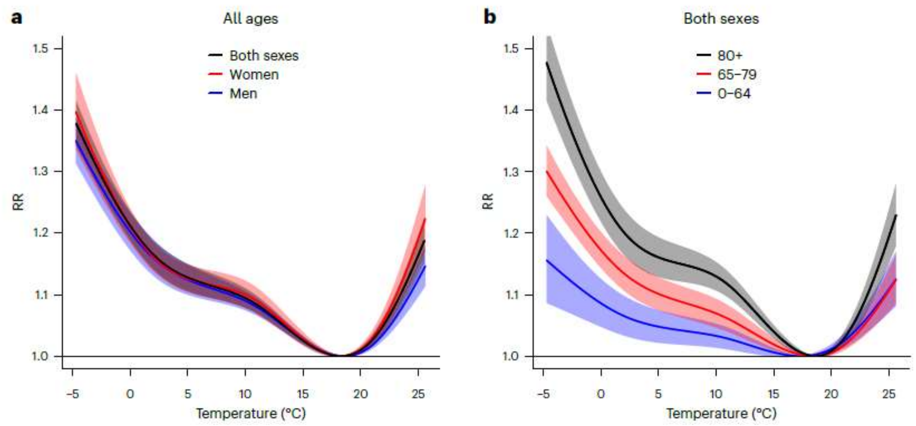
Bhaskaran et al, IJE 2013

Température - mortalité : relations dose-réponse



Masselot et al, *Lancet Plan Health* 2023

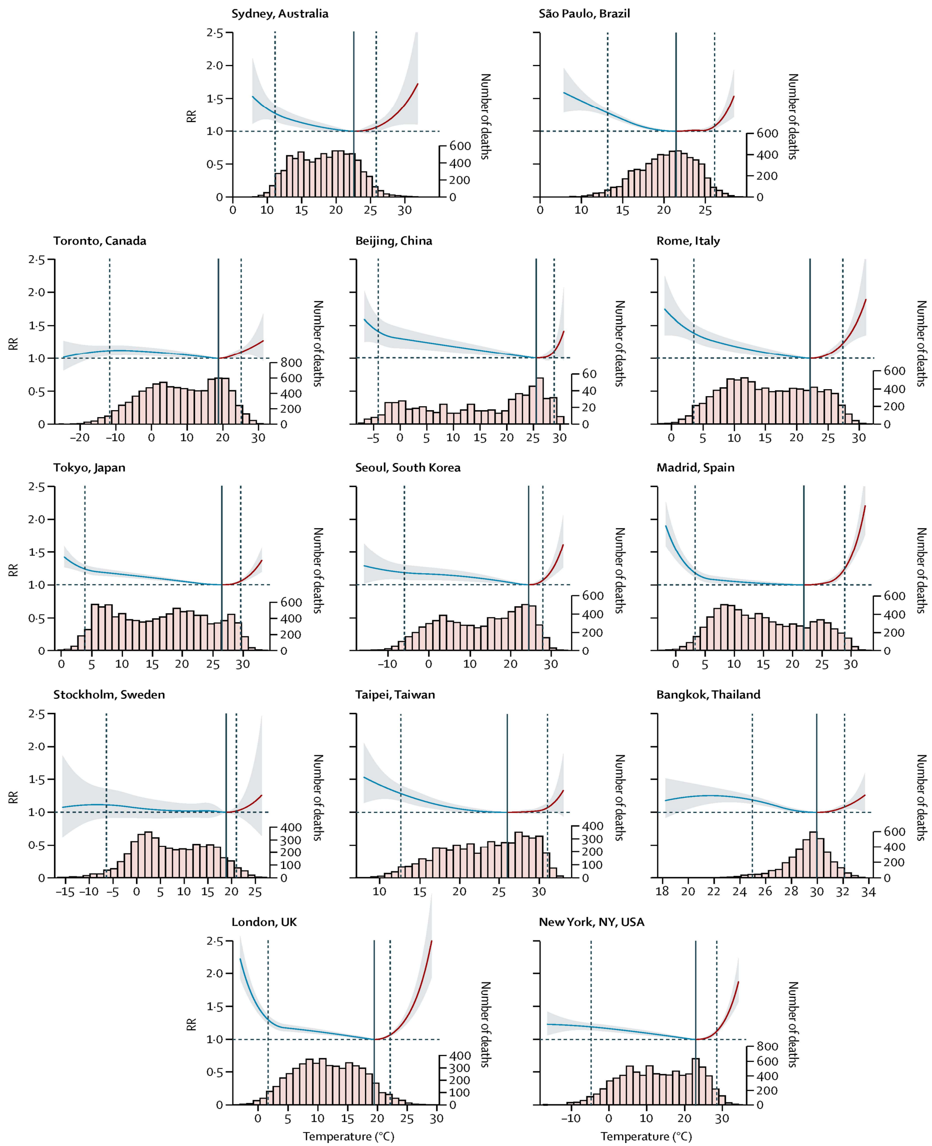
- Forme en U
- Pente beaucoup plus forte aux températures chaudes
- Des variations en fonction de l'âge et du sexe



Ballester et al, *Nature Med* 2023

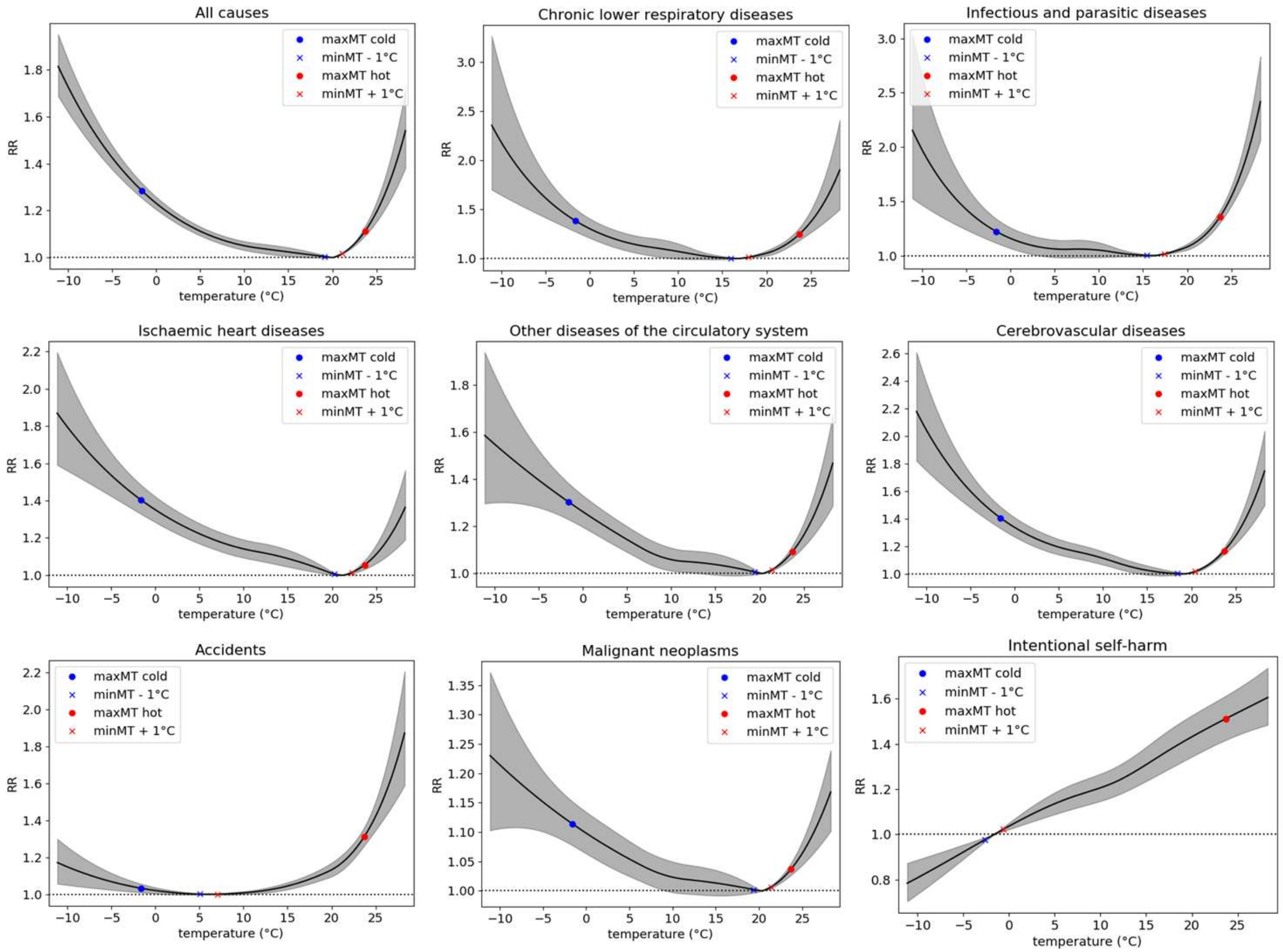
Variabilité géographique dans la relation

- Traduit principalement des formes d'adaptation socio-culturelle



Gasparrini et al, *Lancet* 2015

Les causes de mortalité

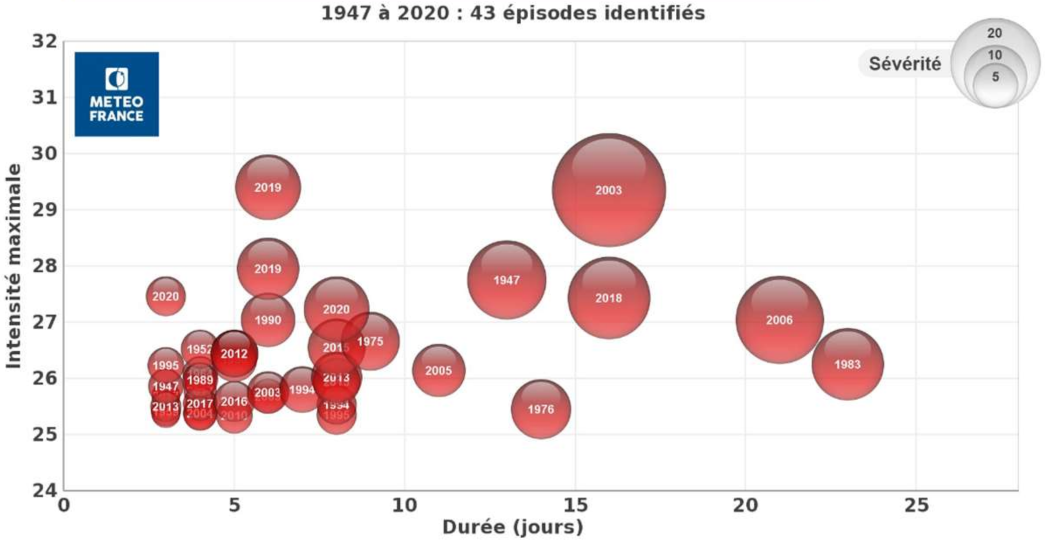


Lehmann et al, *Am. J. Epi* 2022

Impact des vagues de chaleur en France et Europe

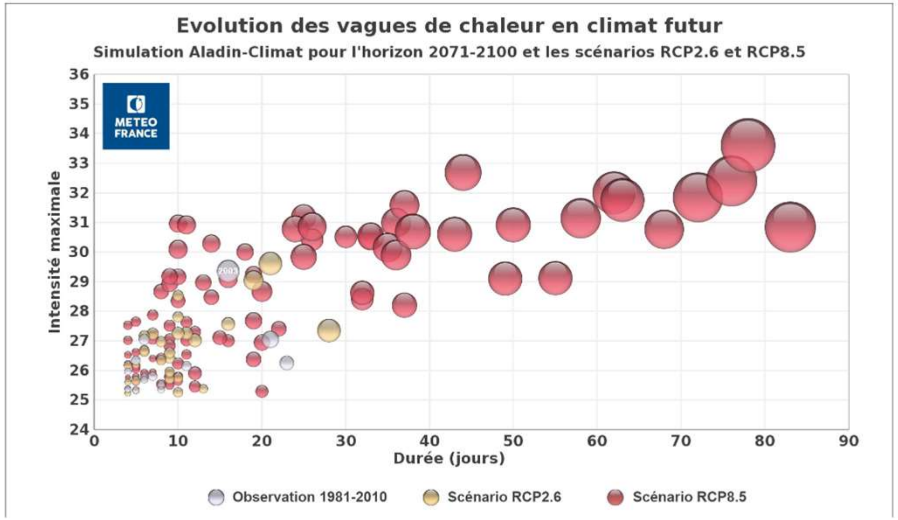
Projection des canicules - France

Les vagues de chaleur observée en France entre 1947 et 2020

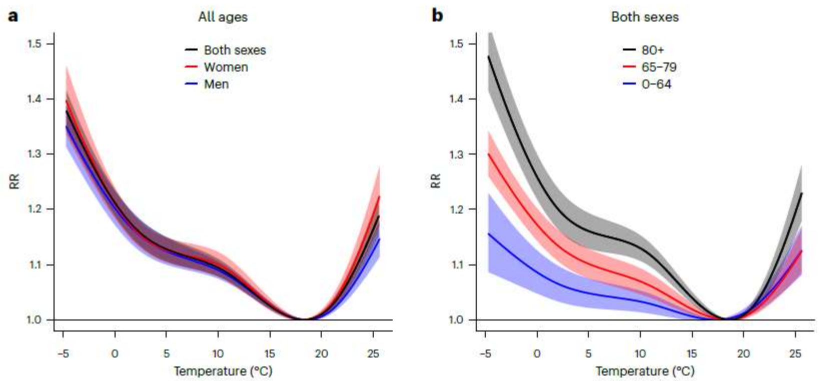


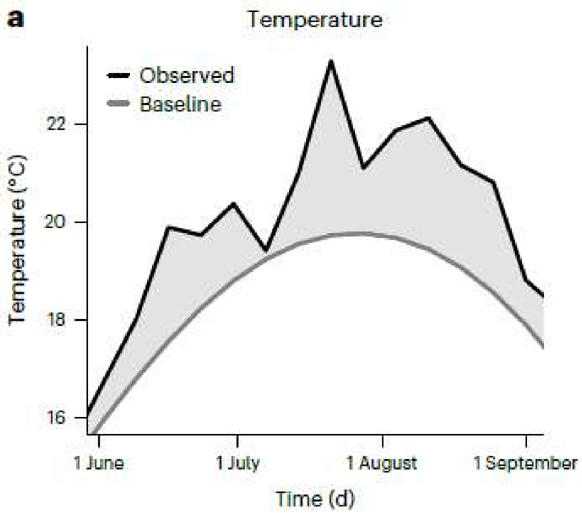
Les vagues de chaleur en France en climat futur

- **Simulation des vagues de chaleur : mise en œuvre pour le modèle Aladin Météo-France Observations 1981-2010 et horizon 2071-2100**



Mortalité liée à la chaleur estivale en Europe





nature medicine

Article
https://doi.org/10.1038/s41591-023-02419-z

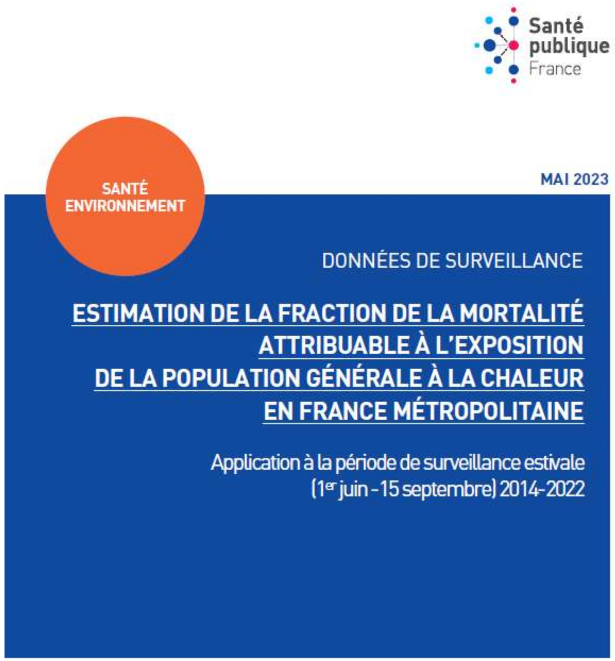
Heat-related mortality in Europe during the summer of 2022

Received: 5 January 2023
Accepted: 24 May 2023
Published online: 10 July 2023
Check for updates

Joan Ballester[1], Marcos Quijal-Zamorano[1,2], Raúl Fernando Méndez Turrubiates[1], Ferran Pegenaute[1], François R. Herrmann[3,4], Jean Marie Robine[5,6,7], Xavier Basagaña[1,2,8], Cathryn Tonne[1,2,8], Josep M. Antó[1,2,8] & Hicham Achebak[1,9]

- **~61,672 décès en excès** (95% CI: 37,643–86,807) entre le 30 mai et le 4 septembre 2022
- En moyenne, les femmes plus touchées que les hommes (mais pas dans toutes les tranches d'âge)

Mortalité liée à la chaleur estivale en France


Santé publique France

MAI 2023

SANTÉ ENVIRONNEMENT

DONNÉES DE SURVEILLANCE

ESTIMATION DE LA FRACTION DE LA MORTALITÉ ATTRIBUABLE À L'EXPOSITION DE LA POPULATION GÉNÉRALE À LA CHALEUR EN FRANCE MÉTROPOLITAINE

Application à la période de surveillance estivale (1er juin - 15 septembre) 2014-2022

- Depuis 2014: 30 000 décès en excès en France
- 7 000 décès en excès pour l'été 2022 (IC: 6 277 - 7 445)
- 30% de ces décès surviennent durant les jours d'alertes canicules
  - 6% des jours de la période, donc le plan de gestion justifié (pics)
  - Mais 70% des décès en dehors des jours d'alertes (plateaux)
- 1/3 des décès concerne les <75 ans

Projections en régime de changements climatiques

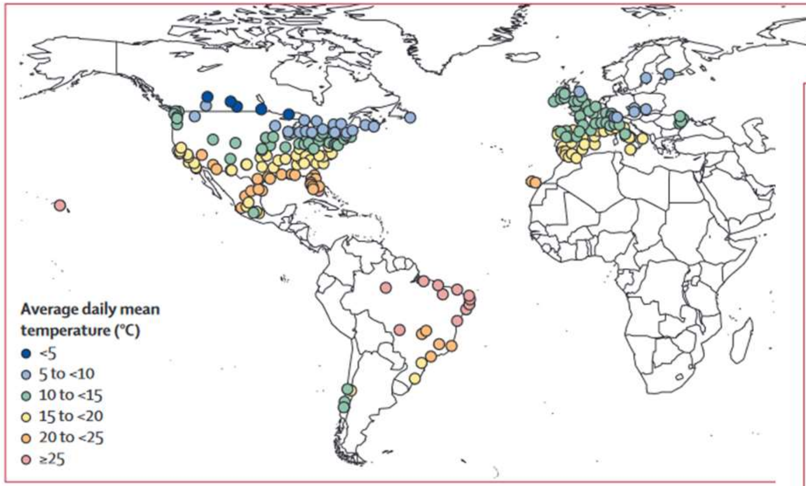


***Figure 1:* Map of the 451 locations included in the analysis**
The locations represent metropolitan areas, provinces, or larger areas from 23 countries within nine region: mean temperature, computed over the study periods shown in table 1.

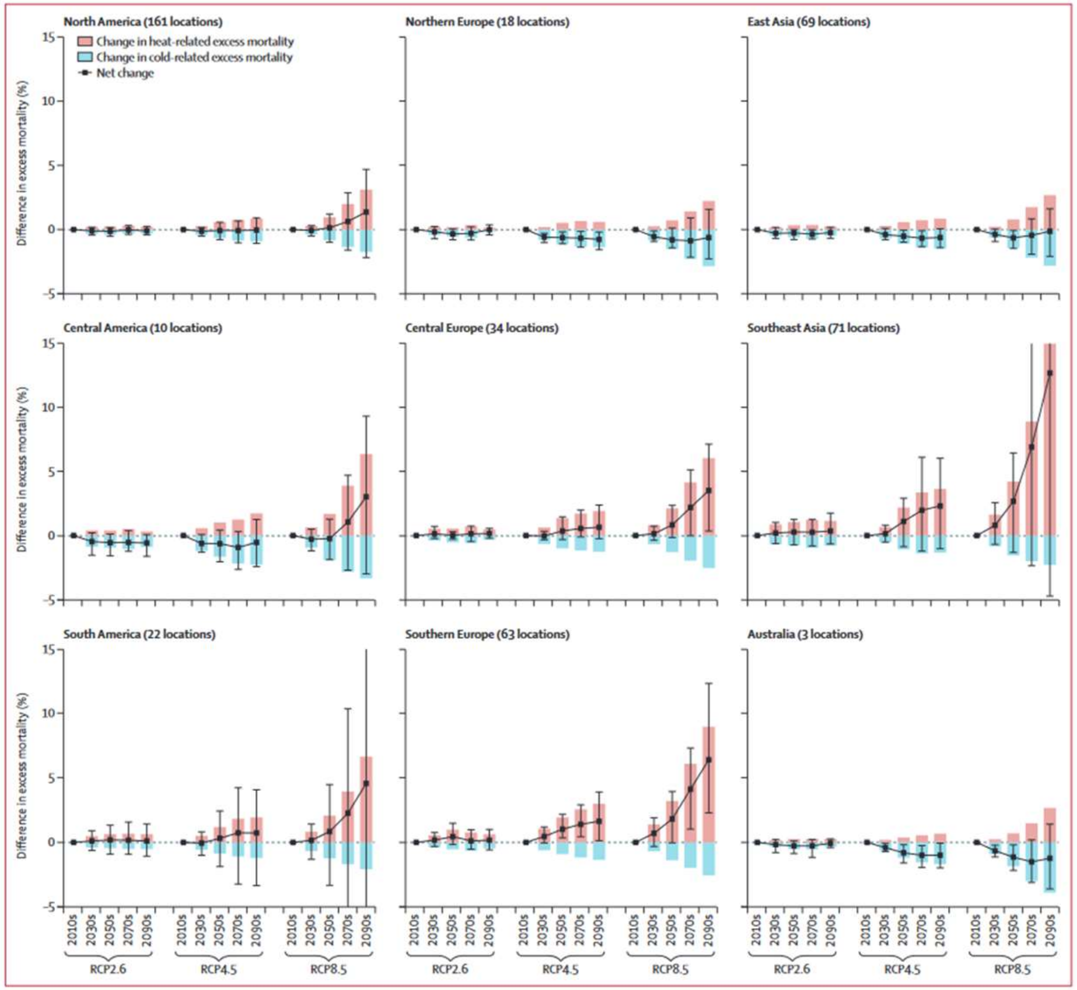


***Figure 3:* Temporal change in excess mortality by region**
The graph shows the difference in excess mortality by decade compared with 2010–19 in nine regions and under three climate change scenarios (RCP2.6, RCP4.5, and RCP8.5). Estimates are reported as GCM-ensemble averages. The black vertical segments represent 95% empirical CIs of net difference. RCP=representative concentration pathway. GCM=general circulation model.

Gasparrini et al, *Lancet Plan. Health* 2017

Des régions inhabitables?

Une approche par la niche écologique

MAT = Mean Annual Temp.

MAT >29°C : seulement 0.3% de la pop. mondiale (12 millions) en 1980

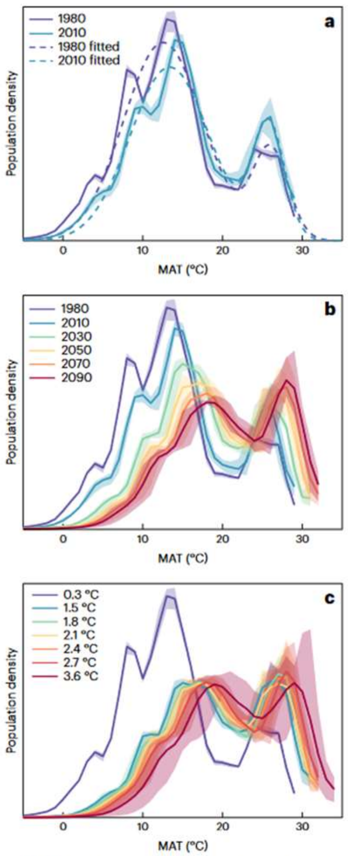


Fig. 1 | Changes in relative human population density with respect to MAT.

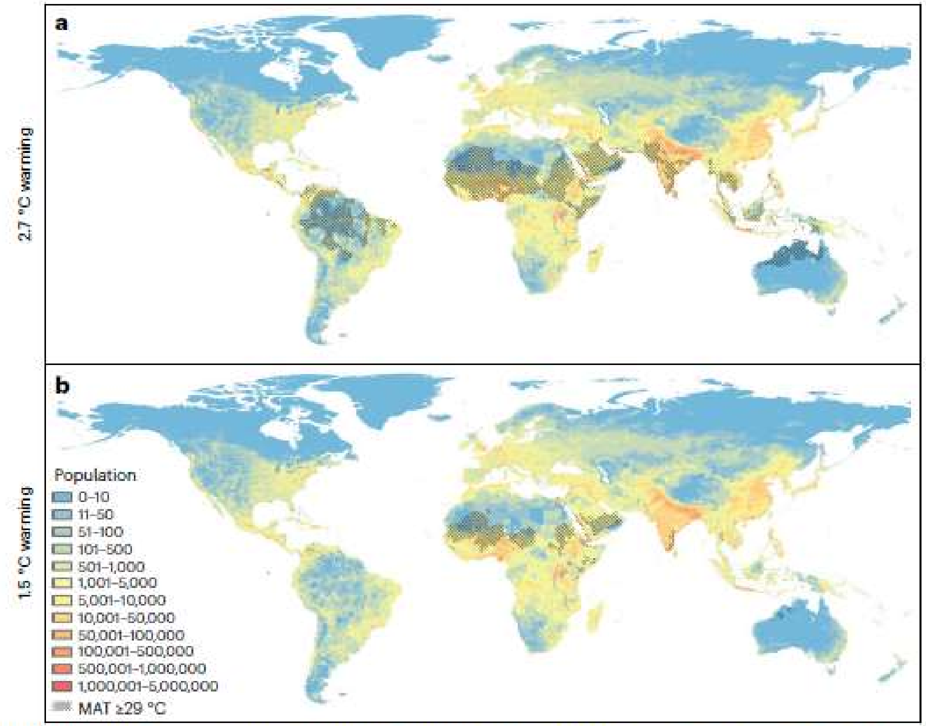


Fig. 4 | Regions and population densities exposed to unprecedented heat at different levels of global warming. a,b, Regions exposed to unprecedented heat (MAT ≥29 °C) overlaid on population density (number in a ~100 km^2 grid cell) for a world of 9.5 billion (SSP2, 2070) under 2.7 °C global warming (**a**) and 1.5 °C global warming (**b**).

Lenton et al, *Nature Sustainability* 2023

Des régions inhabitables?

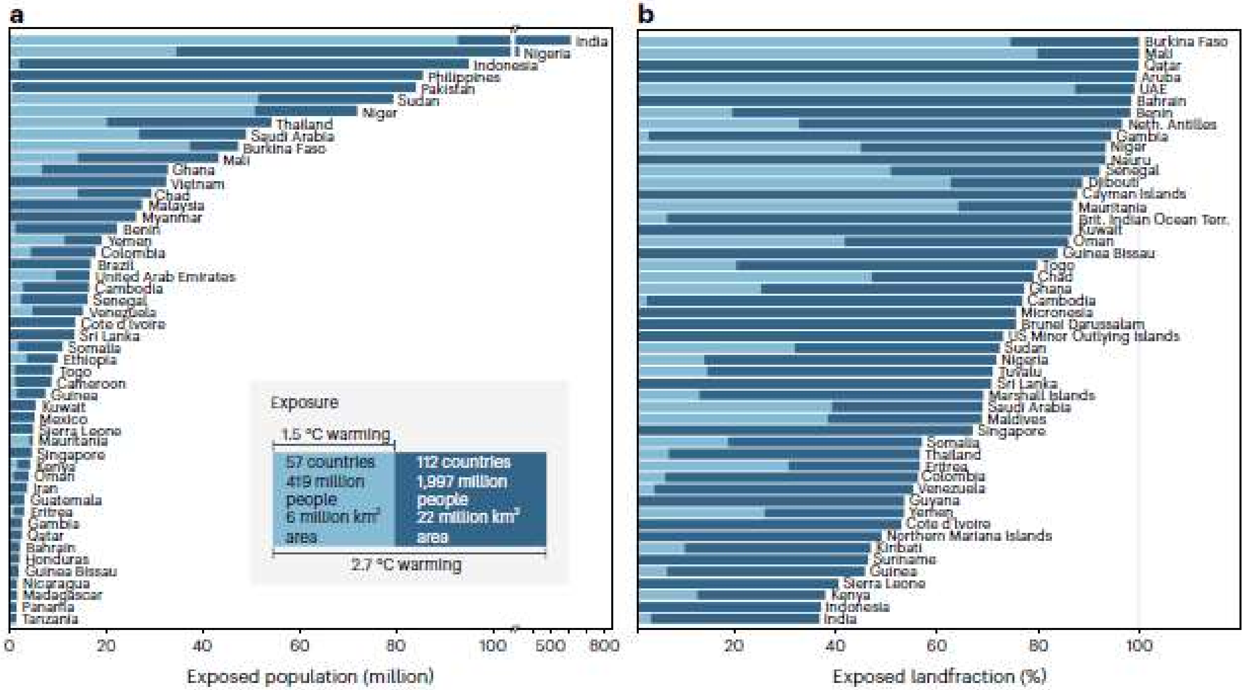


Fig. 5 | Country-level exposure to unprecedented heat (MAT ≥29 °C) at 2.7 °C and 1.5 °C global warming in a world of 9.5 billion people (around 2070 under SSP2). **a**, Population exposed for the top 50 countries ranked under 2.7 °C global warming (dark blue) with exposure at 1.5 °C global warming overlaid (pale blue). Note the break in the *x* axis for the top two countries. **b**, Fraction of land area exposed for the top 50 countries (again ranked under 2.7 °C global warming with results for 1.5 °C global warming overlaid). The inset in **a** summarizes the total global exposure of countries, population and land area at the two levels of global warming, with results for all countries provided in Supplementary Data. UAE, United Arab Emirates; Neth. Antilles, Netherlands Antilles; Brit. Indian Ocean Terr., British Indian Ocean Territory.

Lenton et al, *Nature Sustainability* 2023

Pour +1,5°C : 500 millions d'humains chassés de la niche écologique

Pour +2,7°C : 2 milliards d'humains chassés de la niche écologique

Prévention et adaptation

Prévention individuelle et collective

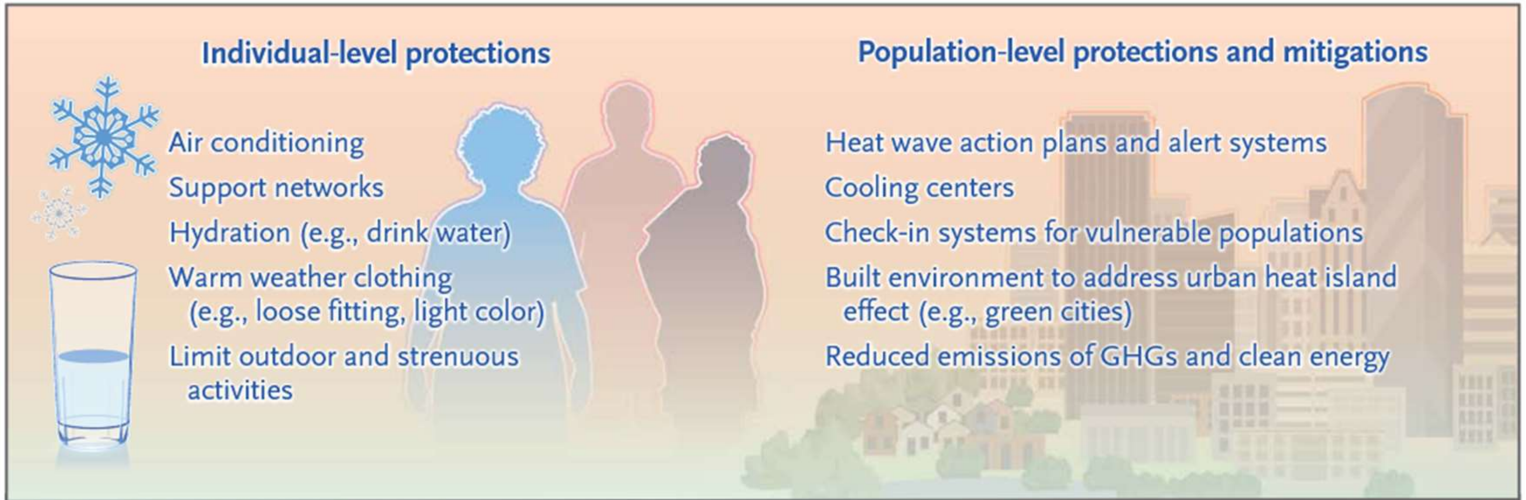
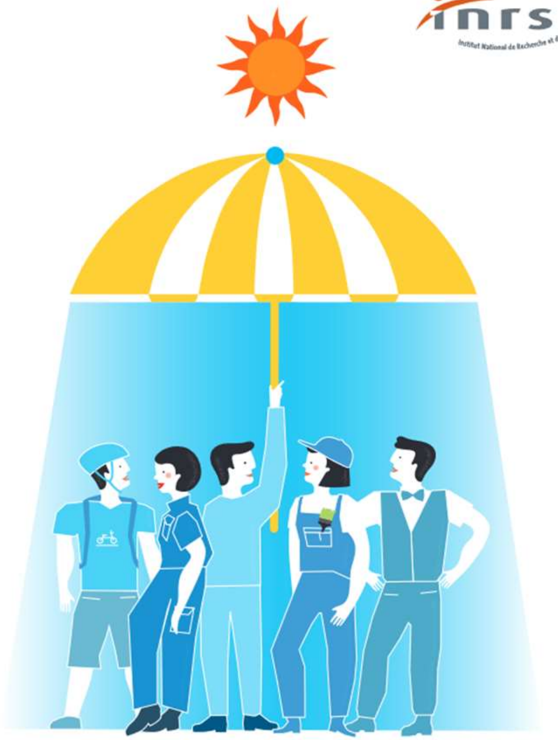


Figure 2. Protective Measures for Heat.

The listed measures are examples; the lists are not exhaustive. GHGs denotes greenhouse gases.

Un facteur sous-estimé: l’acclimatation



Travail par forte chaleur :
comment agir ?

- **Prendre en compte la période d’acclimatation** au minimum de 7 jours d’exposition régulière à la chaleur. Être d’autant plus vigilant si le salarié revient de vacances, d’un congé de maladie ou encore s’il intervient en tant qu’intérimaire ou nouvel embauché.

Adaptation technologique vs. socio-culturelle

The relative value of sociocultural and infrastructural adaptations to heat in a very hot climate in northern Australia: a case time series of heat-associated mortality

Simon Quilty, MPhilPH • Norman Frank Jupurrurla * • Aparna Lal, PhD • Veronica Matthews, PhD † •
Antonio Gasparrini, PhD • Pandora Hope, PhD • et al. Show all authors • Show footnotes

Open Access • Published: August, 2023 • DOI: https://doi.org/10.1016/S2542-5196(23)00138-9 •
THE LANCET Planetary Health

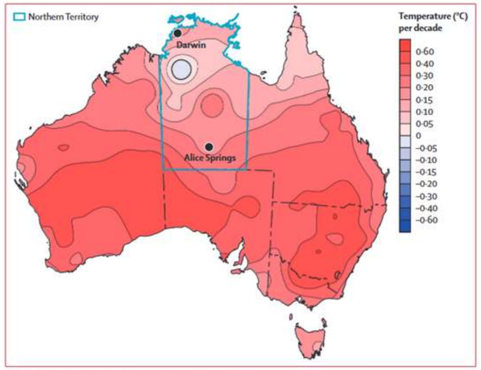


Figure 1: Temperature trends across Australia, 1980–2019

Climatisation dans les logements pour les pop. non aborigènes :

- 52% en 1980
- 93% en 2010

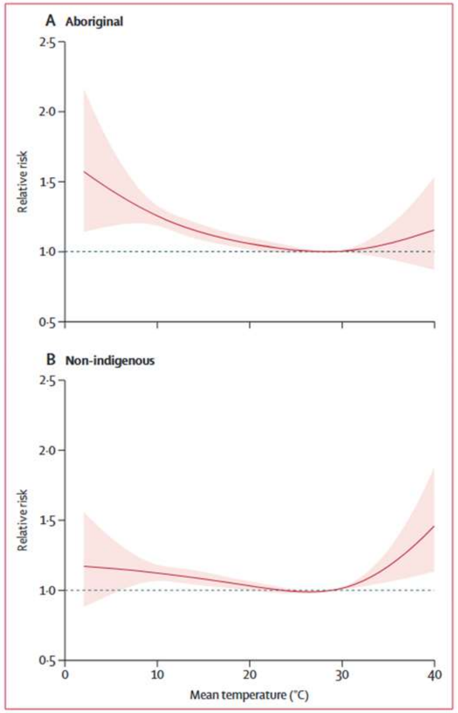


Figure 2: Relative risk for temperature associated deaths by mean temperature (3-day lag) for Aboriginal (A) and non-Indigenous (B) people, 1980–2019
Red shading indicates 95% CI.

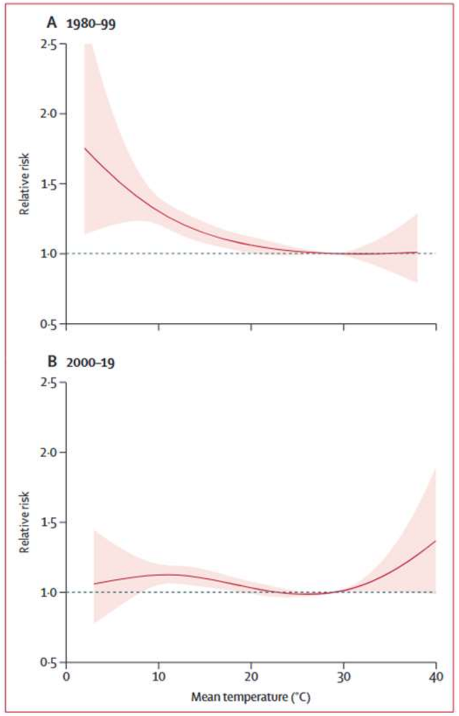
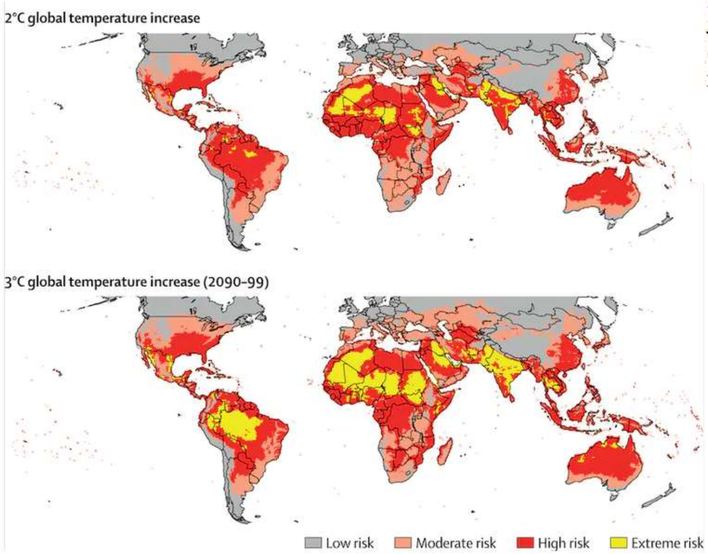


Figure 3: Total deaths by mean temperature (3-day lag) from 1980 to 1999 (A) and from 2000 to 2019 (B)
Red shading indicates 95% CI.

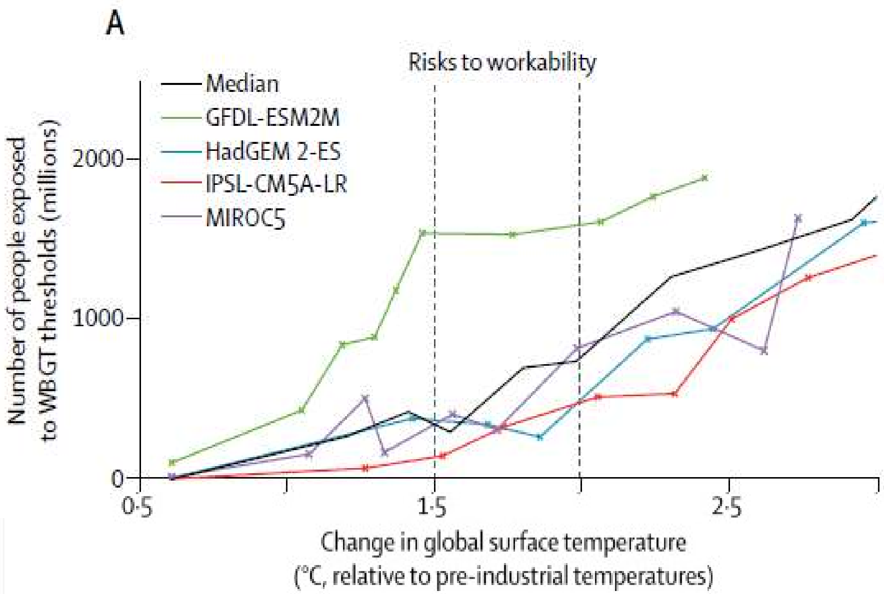
Chaleur, conditions de travail, productivité

Chaleur et conditions de travail

Nombre de personnes exposées à des conditions climatiques (**Tw**) non compatibles avec le travail au moins 1 mois/an



Les conséquences des vagues de chaleur en fonction de l'augmentation globale des températures.



Probable creusement des inégalités sociales

Andrews et al, *Lancet Planetary Health* 2018

Pertes en productivité et potentiels d'adaptation

Travaux récents de l'équipe de Luke Parsons (Duke Univ., US)

Ré-évaluation à la hausse des pertes d'heures travaillées:

- 650 milliards d'h/an
- 148 millions d'ETP
- Équivalent des pertes liées au Covid-19

nature COMMUNICATIONS

ARTICLE

https://doi.org/10.1038/s41467-021-27328-y OPEN

Increased labor losses and decreased adaptation potential in a warmer world

Luke A. Parsons[1], Drew Shindell[1], Michelle Tigchelaar[2], Yuqiang Zhang[1,3] & June T. Spector[4]

Potentiel limité d'adaptation :

- 30% des heures perdues « récupérables » par changement d'horaire
- Potentiel qui ↘ avec le réchauffement

ENVIRONMENTAL RESEARCH LETTERS

LETTER

OPEN ACCESS

RECEIVED 20 July 2021

REVISED 5 October 2021

Global labor loss due to humid heat exposure underestimated for outdoor workers

Luke A Parsons[1,*], Yuta J Masuda[2], Timm Kroeger[2], Drew Shindell[1], Nicholas H Wolff[2] and June T Spector[4]

Convergence des enjeux santé et climat

La santé comme levier d'action : convergence des objectifs santé et climat

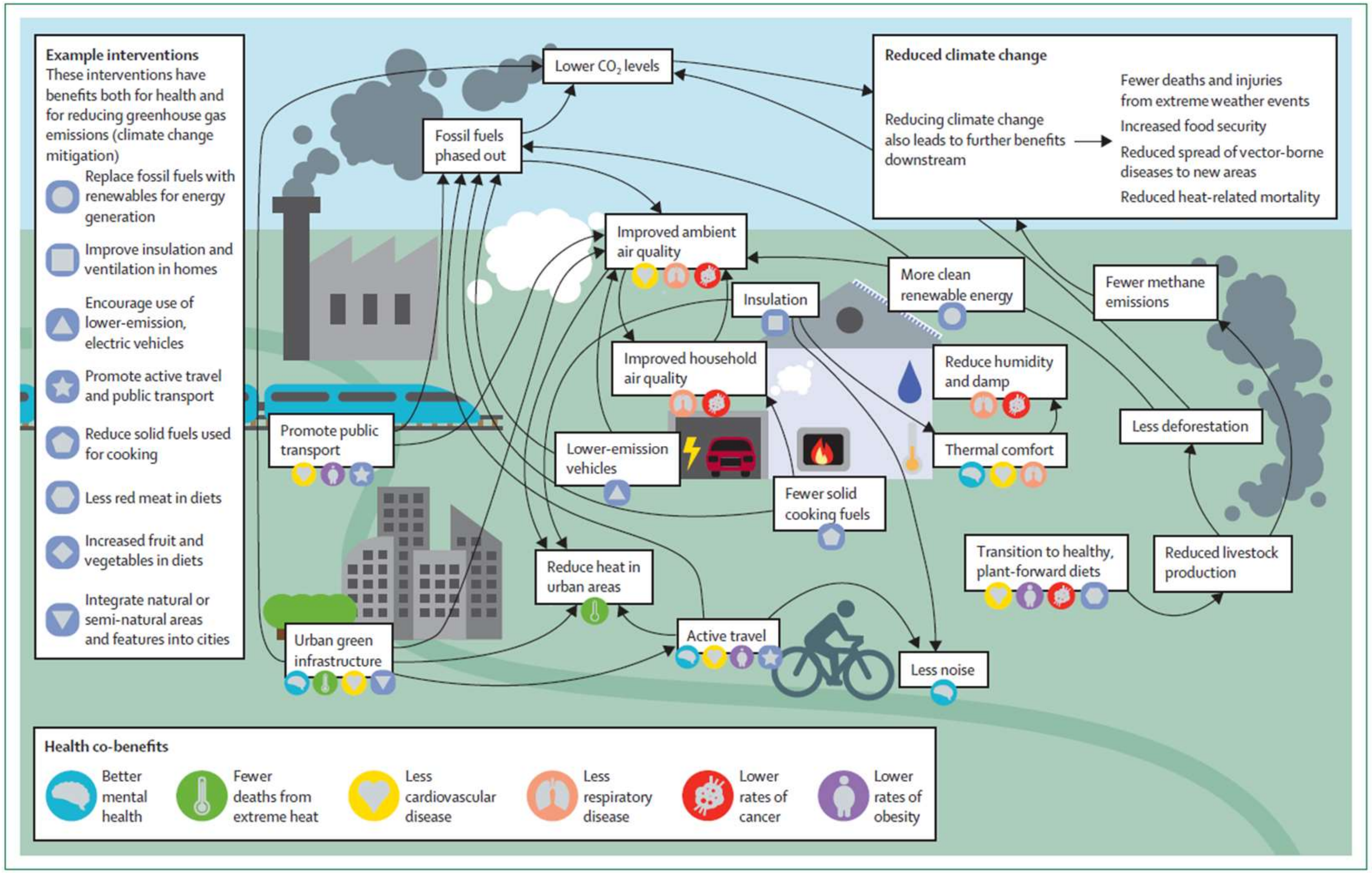


Figure 1: Key pathways and connections between climate mitigation actions and health

bon pote

ARTICLES RÉDIGÉS (3)

7 min de lecture

Le meilleur remède contre l'éco-anxiété

Société

7 min de lecture

Tout ce qui est bon (ou presque) pour le climat est bon pour la santé

Environnement | Santé | Solutions

16 min de lecture

Santé et climat : 7 bonnes raisons de lutter contre le réchauffement climatique

Société | Santé | Solutions

ENS PSL ★ UNIVERSITÉ PARIS

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Laboratoire **MESuRS**

kevin.jean@ens.psl.eu

Merci pour votre attention

REACTIONS TO HEATWAVES

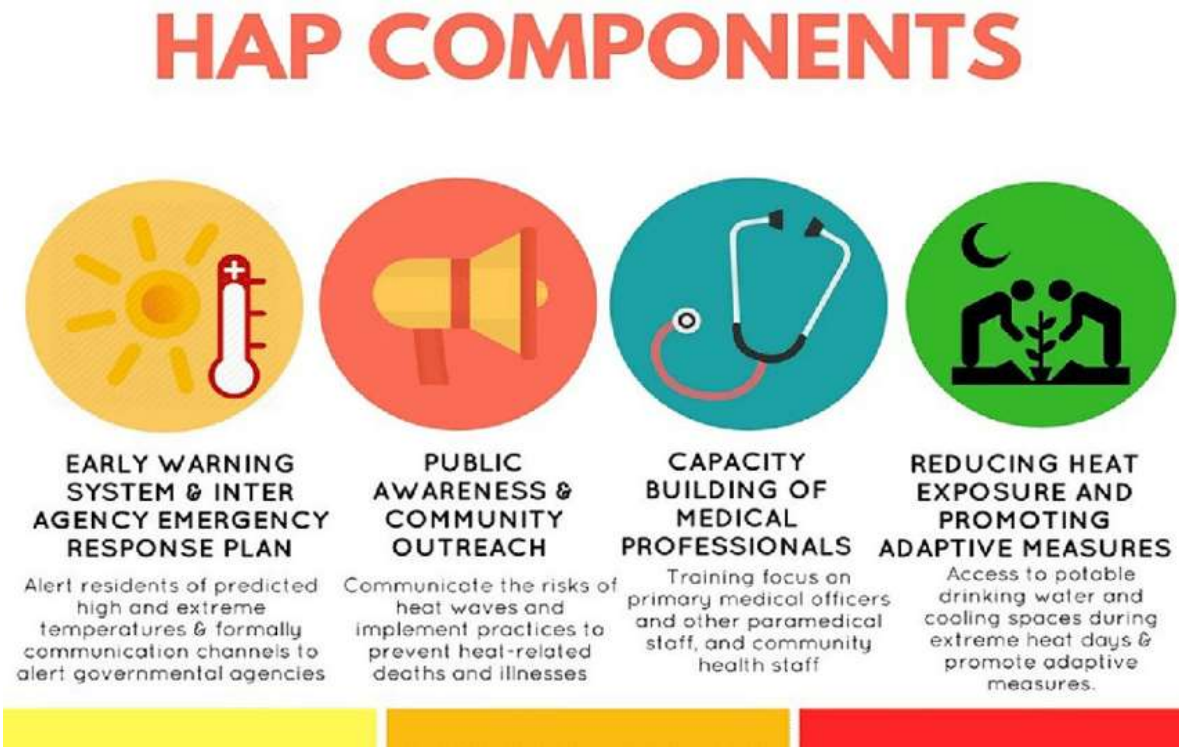
Dr Lana Whittaker,
Liverpool School of Tropical Medicine

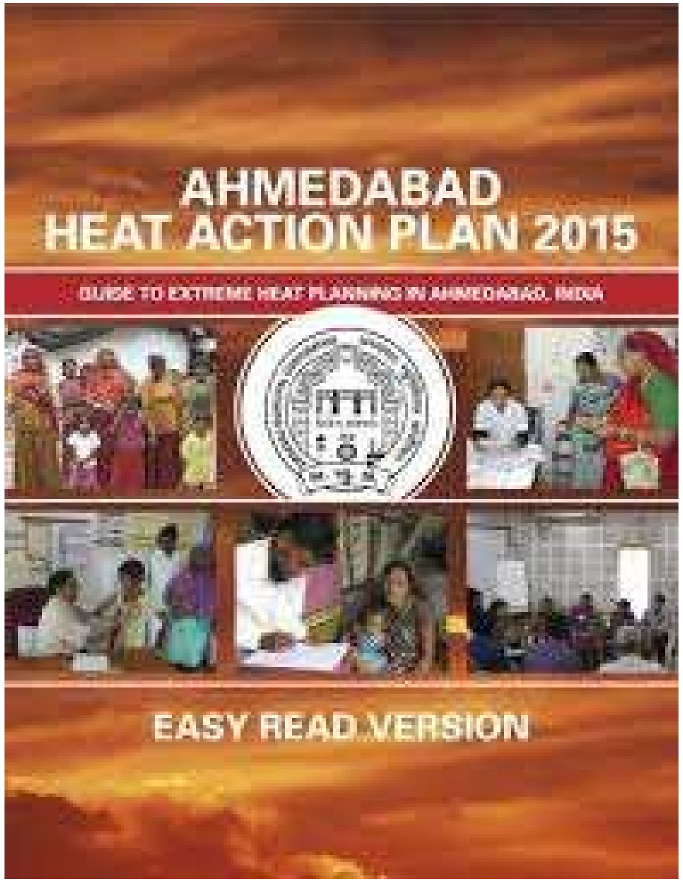
REDUCING THE IMPACTS OF HEAT ON HEALTH

GLOBAL HEAT HEALTH INFORMATION NETWORK

https://ghhin.org/about-us/

HEAT HEALTH ACTION PLANS AND WARNING SYSTEMS





AWARENESS AND COMMUNICATION

Lusambili et al., (2023, 2024)

CHAMNHA
CLIMATE, HEAT AND
MATERNAL AND NEONATAL
HEALTH IN AFRICA

STRUCTURAL: ENVIRONMENT AND BUILDINGS

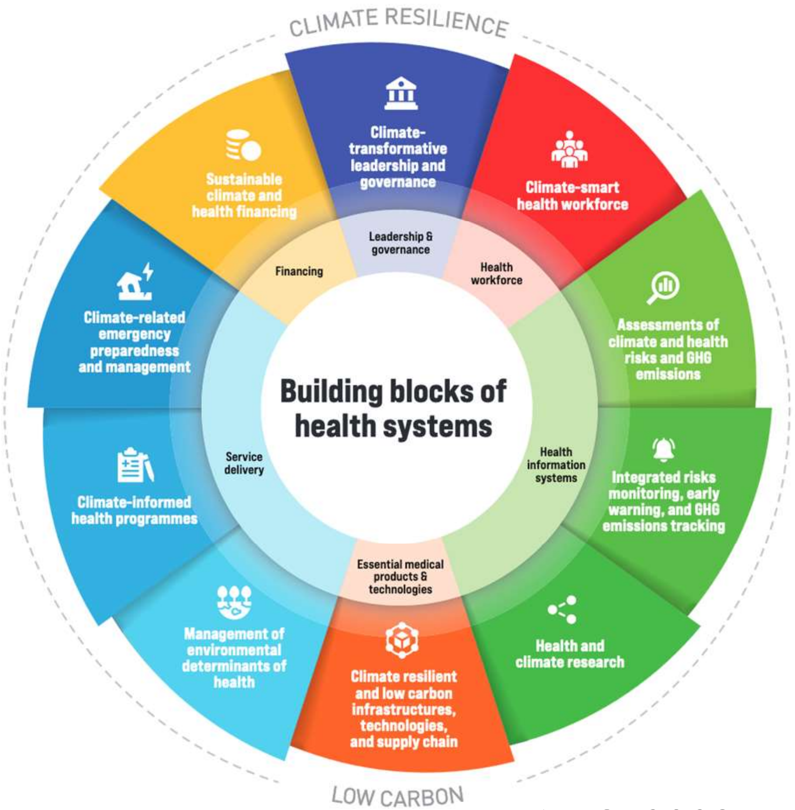
BBC, 2023

Roof Over Our Heads

ROOH, 2024

HEALTH SYSTEM RESILIENCE

1. Operational framework for climate resilient and low carbon health systems



WHO, 2023

CHECKLIST FOR ASSESSING VULNERABILITY TO HEATWAVES

WHO, 2021

HEATWAVES		Vulnerability level		
	High: unprepared; unable to respond (Higher risk) **Medium:** basic or incomplete preparation; low level of response (Medium risk) **Low:** prepared; able to respond (Lower risk)	High	Medium	Low
HEALTH WORKFORCE	**Is the health workforce,**			
	(Human resources)			
	equipped with a plan to identify and protect health workers at risk of heat stress?	☐	☐	☐
	provided with appropriate clothes (e.g. light, loose-fitting cotton clothes, and when necessary, a hat)?	☐	☐	☐
	provided with sunscreen, hat and plenty of drinking water for staff carrying out outdoor activities?	☐	☐	☐
	provided with safe water during a heatwave event and stimulated regularly for appropriate water intake?	☐	☐	☐
	provided with a cool space or a shower room for staff?	☐	☐	☐
	provided with an information system to manage occupational safety and health in the facility during a heatwave, including rest for staff?	☐	☐	☐
	(Capacity development)			
	trained on public health and climate change hazards, including health impacts related to heatwaves?	☐	☐	☐
	trained to manage hazardous waste (chemical, biological, radiological)?	☐	☐	☐
	prepared and able to follow-up a contingency plan for emerging health workforce heat stress, water- and air-borne diseases, and cardiovascular and respiratory problems?	☐	☐	☐
	able to implement a contingency plan for public health emergencies, in case of high temperature effects, and water and food contamination?	☐	☐	☐
	trained and have specific and clear guidance on actions to reduce heat risk factors for staff?*	☐	☐	☐