# Impact of Heatwaves on public health and Health sector Heat Action Plan

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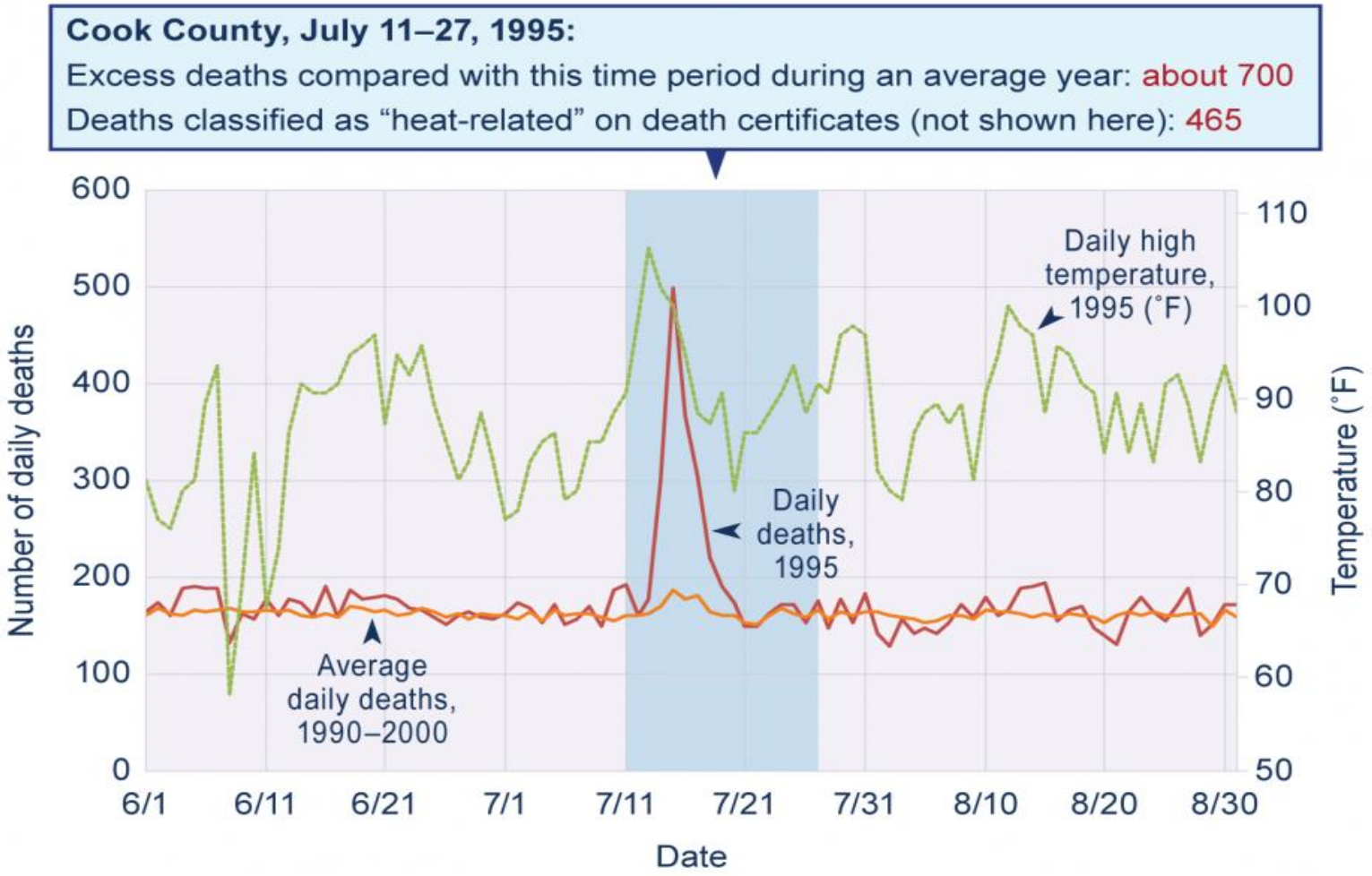
**Center of Excellence for Heat Health, NCDC, Ministry of Health and Family Welfare, Government of India**

# Cook County - Chicago Heat Wave 1995

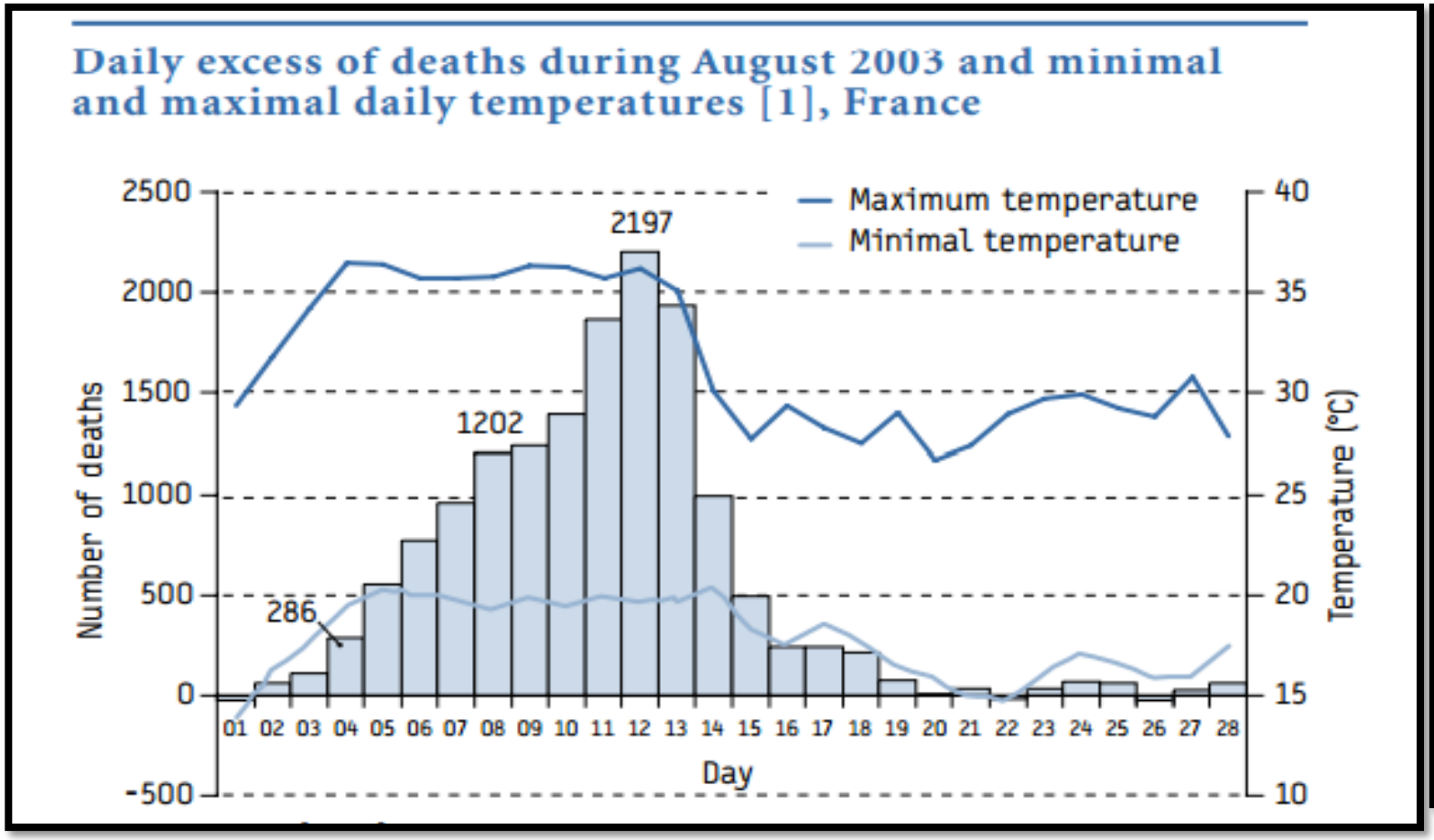



*Semenza JC, Rubin CH, Falter KH, Selanikio JD, Flanders WD, Howe HL, Wilhelm JL. Heat-related deaths during the July 1995 heat wave in Chicago. New England journal of medicine. 1996 Jul 11;335(2):84-90.*

# Hospitals over crowed: Who are affected in heat wave: old, isolated, without cooling or support

# Mass Grave in Chicago after Heat Wave

# European Heat Wave 2003



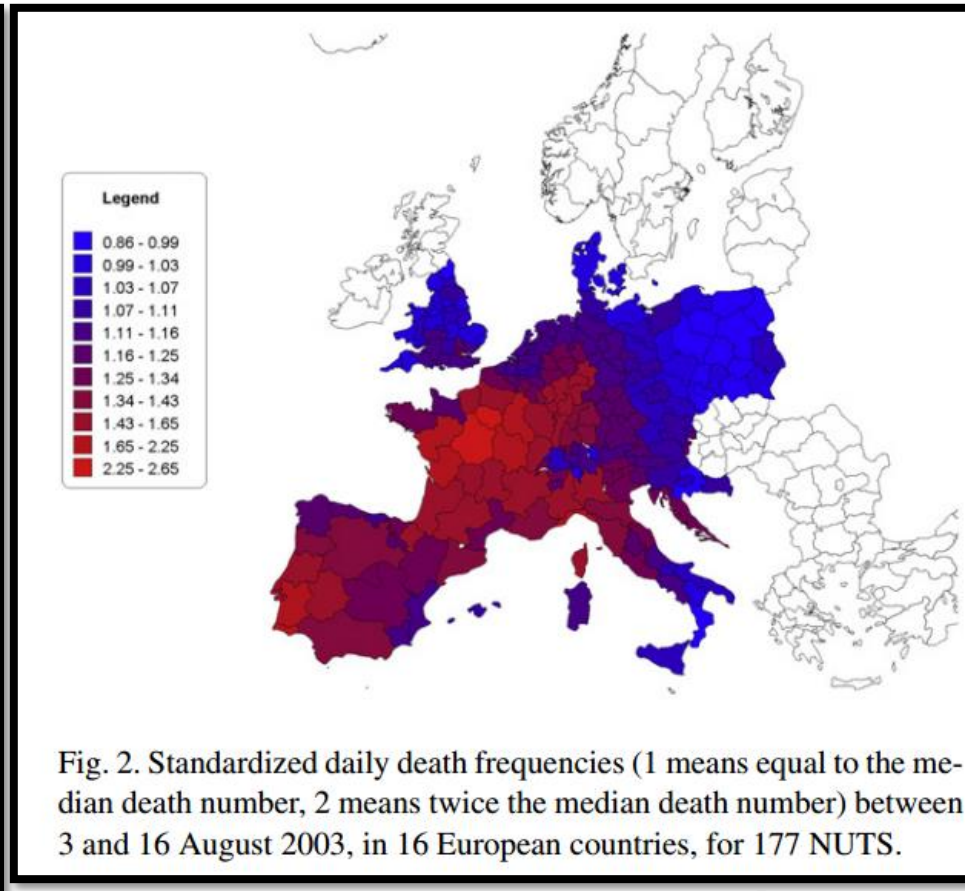




Fig. 2. Standardized daily death frequencies (1 means equal to the median death number, 2 means twice the median death number) between 3 and 16 August 2003, in 16 European countries, for 177 NUTS.

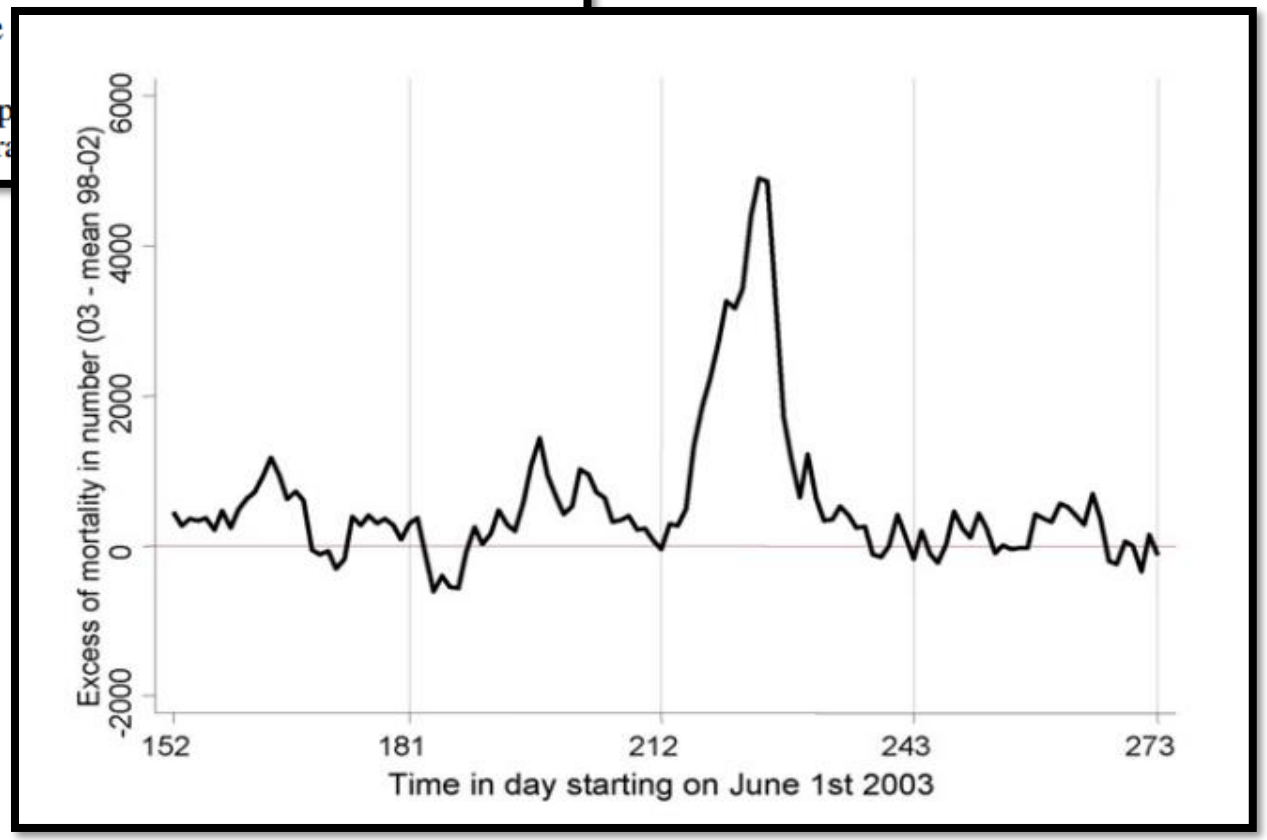
# Heat wave in Europe – gross increase in mortality

Available online at www.sciencedirect.com
ScienceDirect
C. R. Biologies 331 (2008) 171–178
COMPTES RENDUS BIOLOGIES
http://france.elsevier.com/direct/CRASS3/

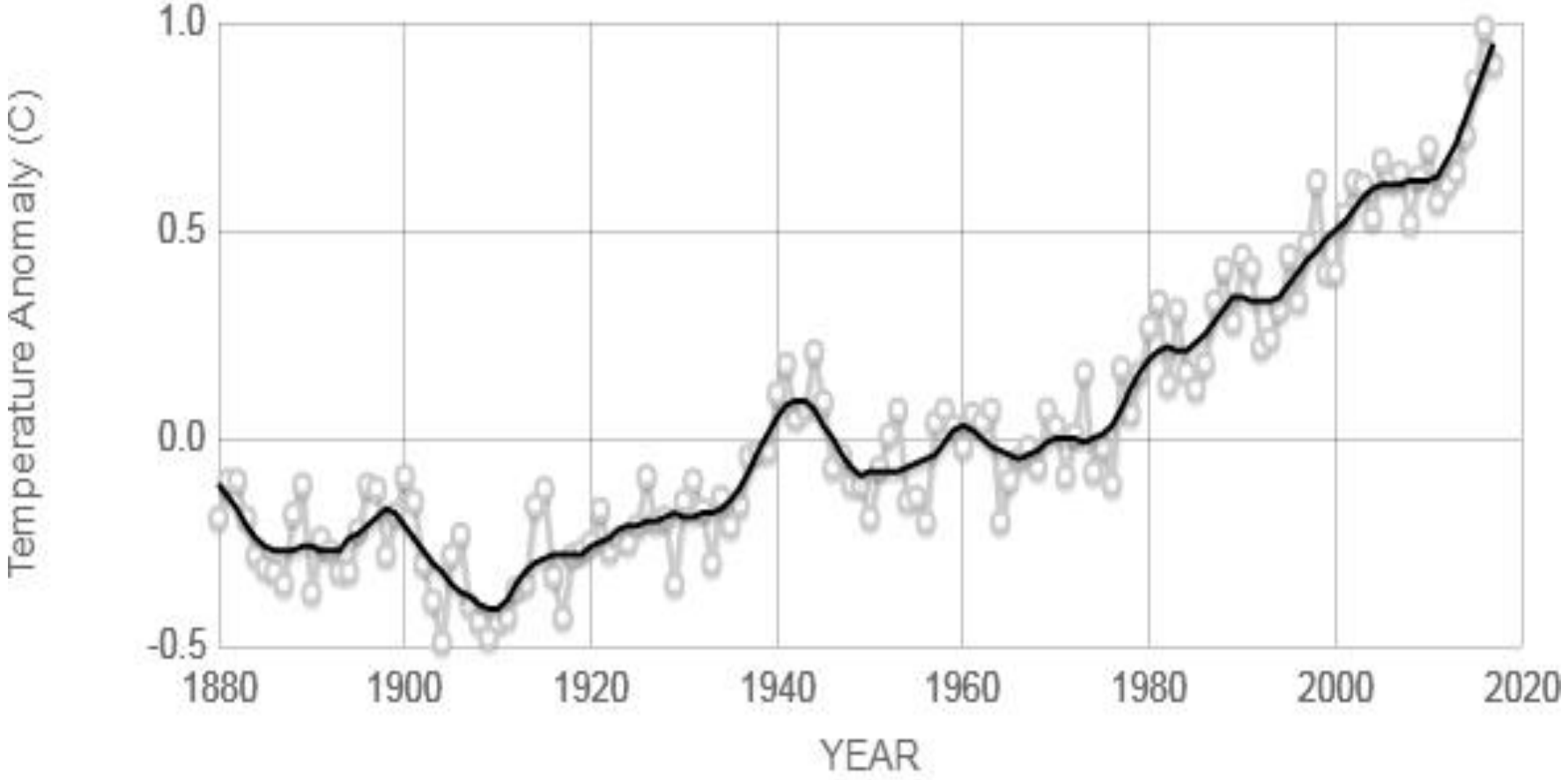
Epidemiology / Épidémiologie

## Death toll exceeded 70,000 in Europe

Jean-Marie Robine [a,*], Siu Lan K. Cheung [a], Sop
Clare Griffiths [c], Jean-Pierre Michel [d], Fra



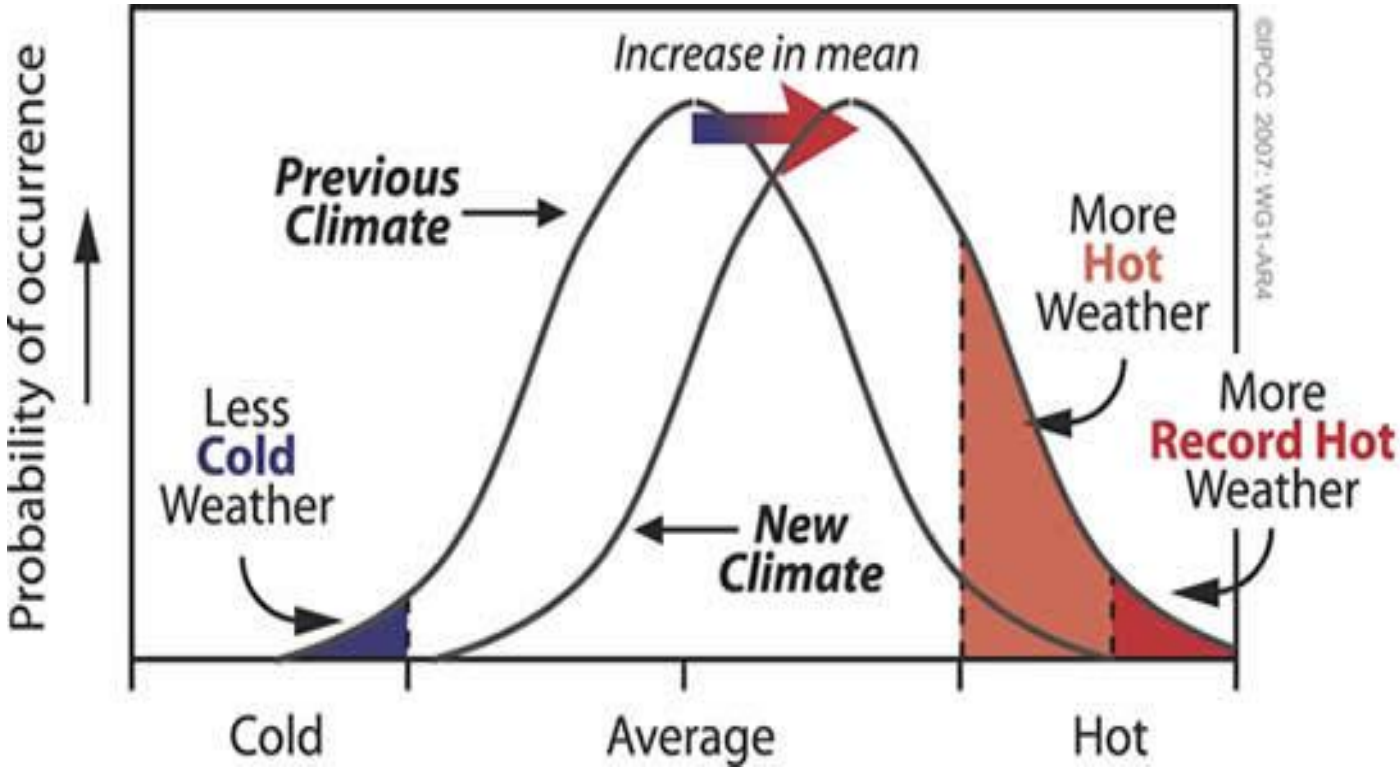
# Global Trend in Increase in Temperature




Source: climate.nasa.gov

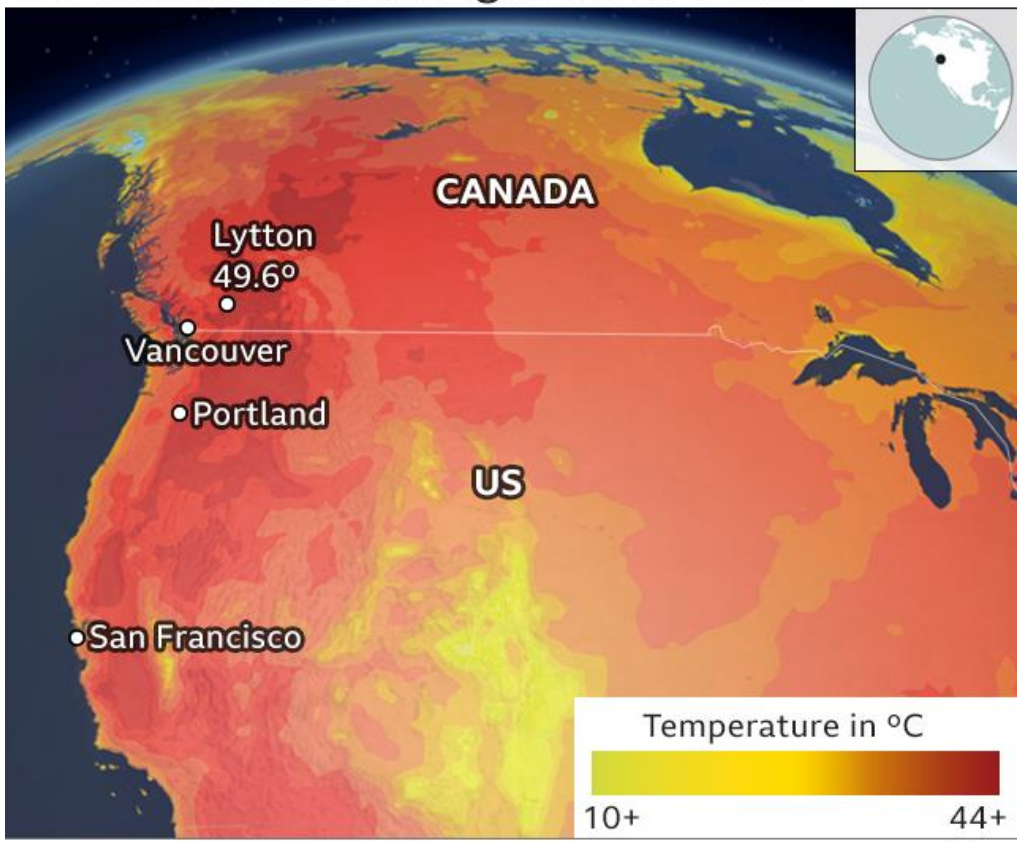
# Climate change Contributes to extreme heat

- **Climate Change**
  - Increase in global average temperature
  - Increase in duration, frequency and extremes of heatwaves
  - Fast increase in night time temperature
- Summer season temperatures are projected to continue to increase
  *(Source: Zhang et al., 2019)*



# Heat wave in Canada – many case – some deaths June 29th 2021.  49.5 deg C!!!

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

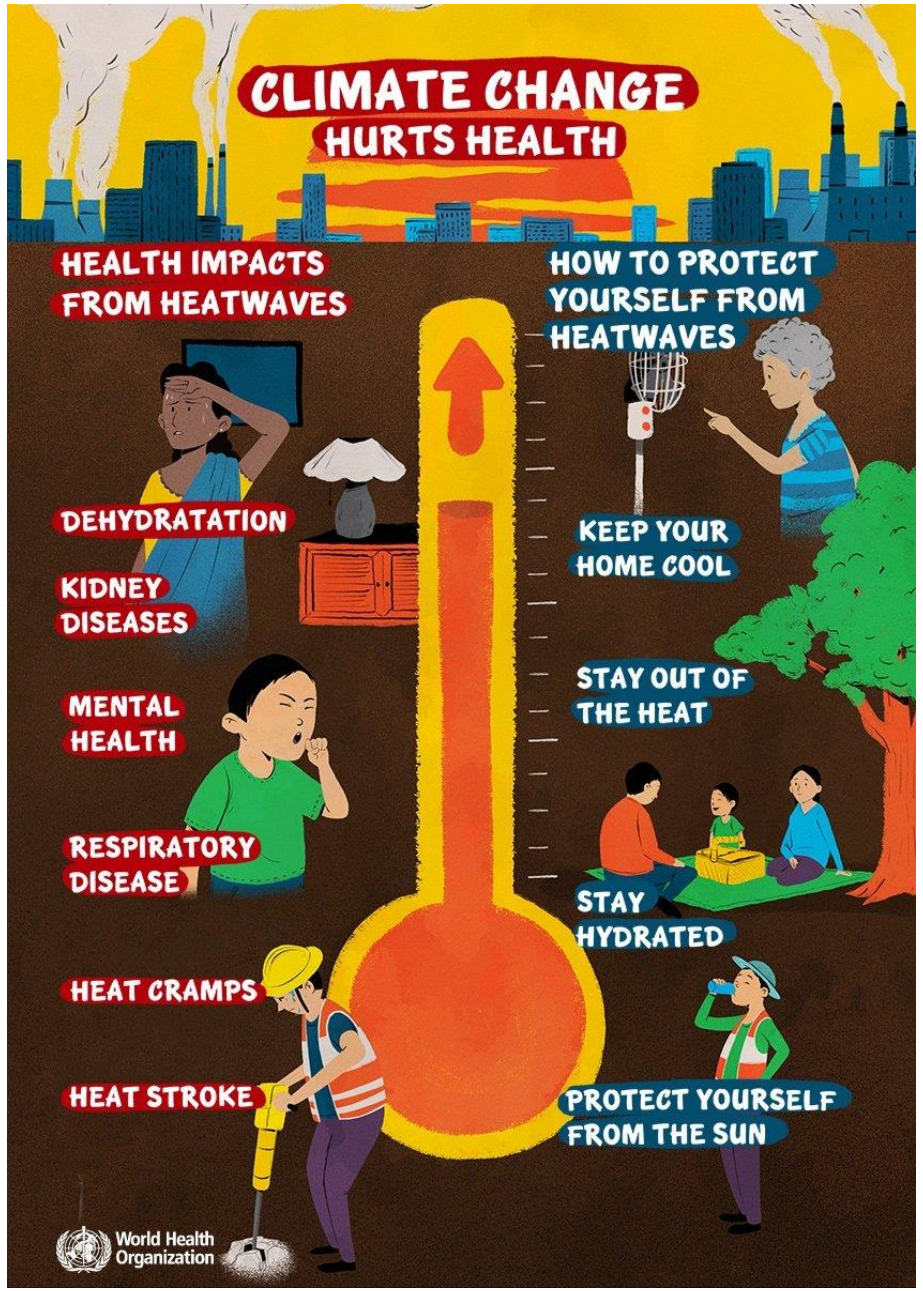



Source: BBC Weather

BBC

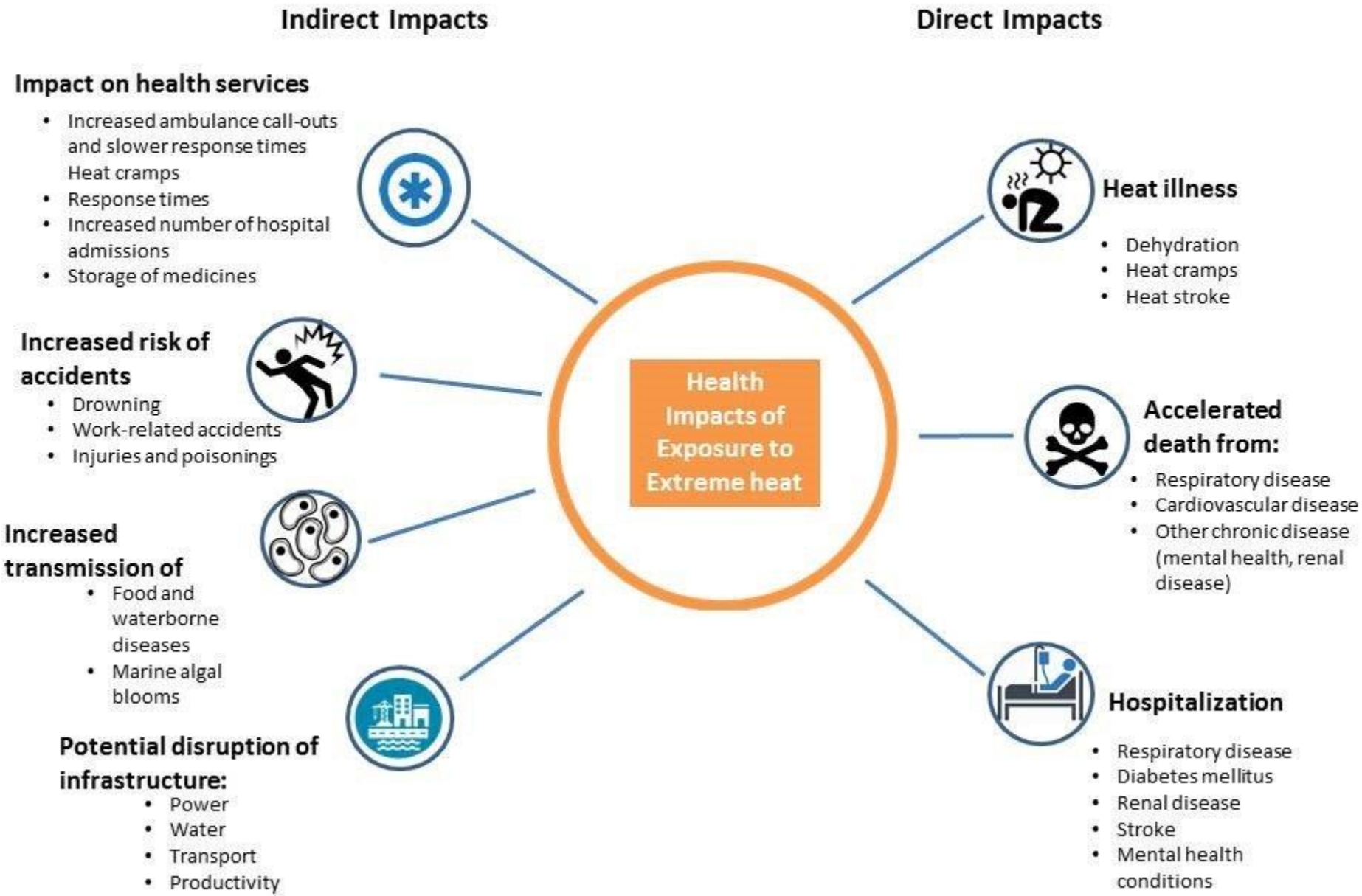
# Impact of heat waves on Human and animal health

- Direct Medical impacts – heat cramps, heat syncope, heat stroke, Death
- Aggravation of pre-existing comorbidities – dehydration, kidney and heart problems etc.
- Decrease productivity of humans and animals– Also milk output
- Increase conflicts / fights  - increased mental health issues
- Water scarcity related problems.

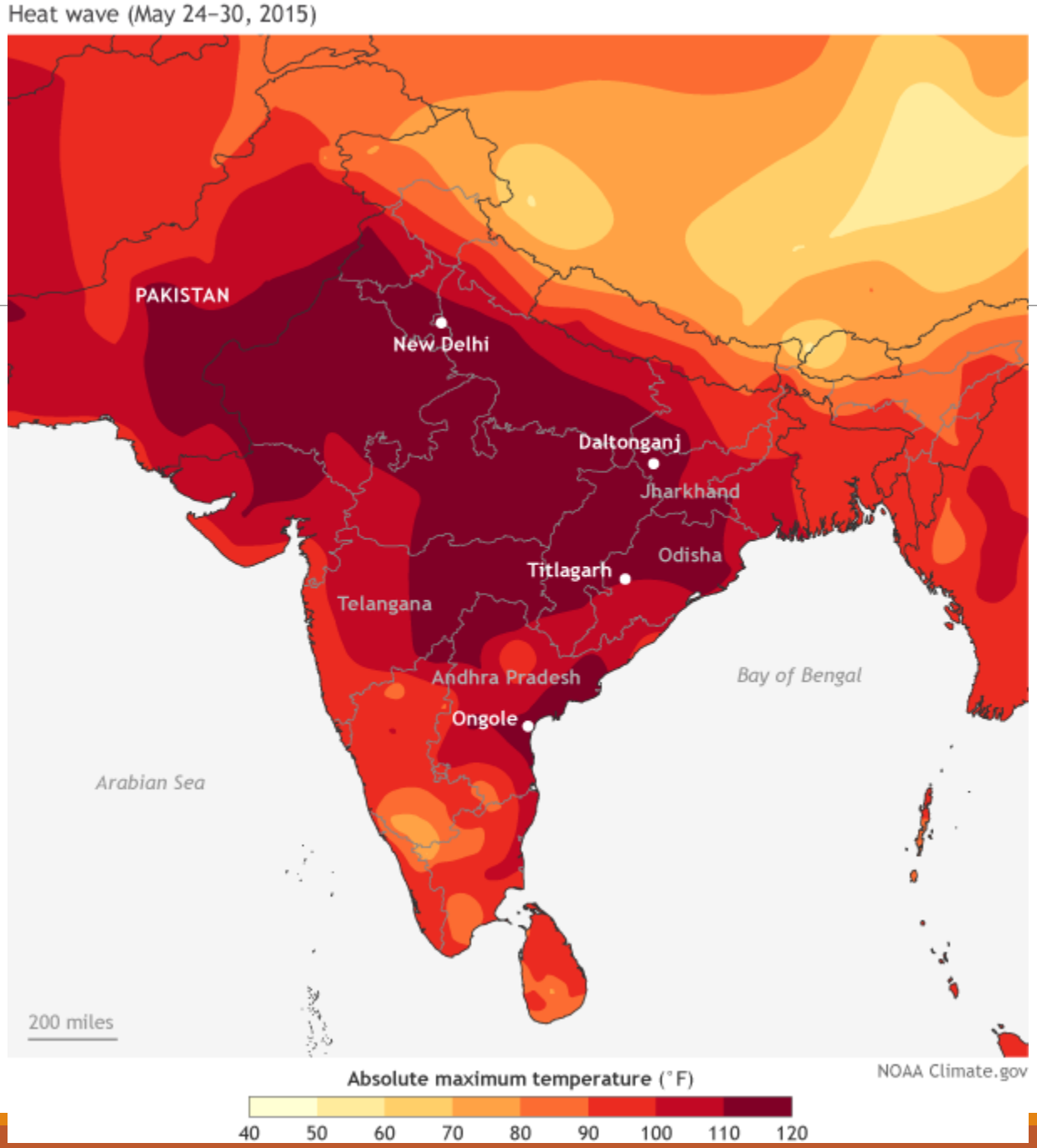



# Health impacts of heat due to climate change

- **Other Impacts on environment**
- Increased urban fires
- Forest fires
- Air pollution…. Due to fires

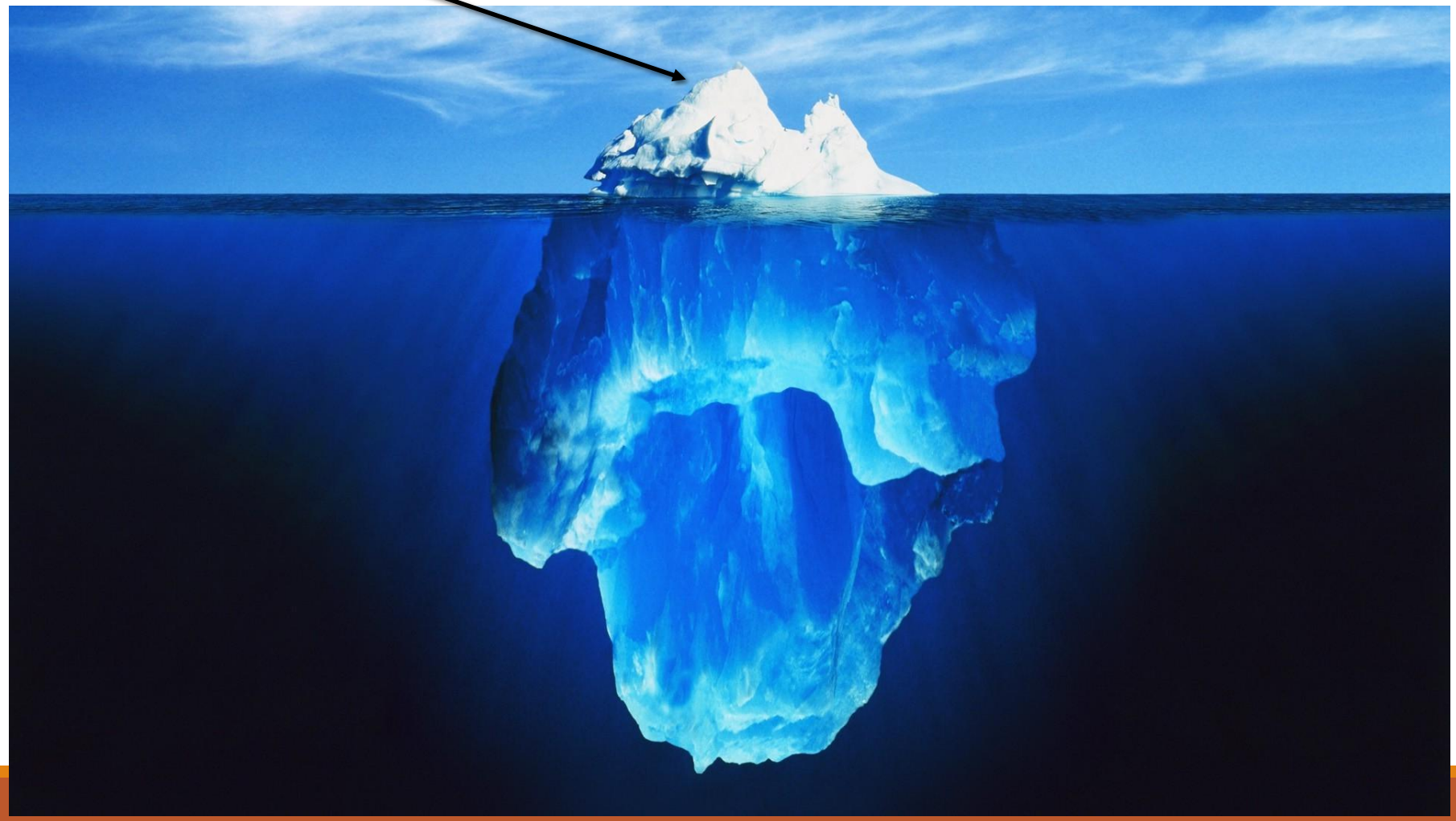

Indirect Impacts
Direct Impacts
Impact on health services
Increased ambulance call-outs and slower response times
Heat cramps
Response times
Increased number of hospital admissions
Storage of medicines
Increased risk of accidents
Drowning
Work-related accidents
Injuries and poisonings
Increased transmission of
Food and waterborne diseases
Marine algal blooms
Potential disruption of infrastructure:
Power
Water
Transport
Productivity
Health Impacts of Exposure to Extreme heat
Heat illness
Dehydration
Heat cramps
Heat stroke
Accelerated death from:
Respiratory disease
Cardiovascular disease
Other chronic disease (mental health, renal disease)
Hospitalization
Respiratory disease
Diabetes mellitus
Renal disease
Stroke
Mental health conditions

# Heat wave in 2015



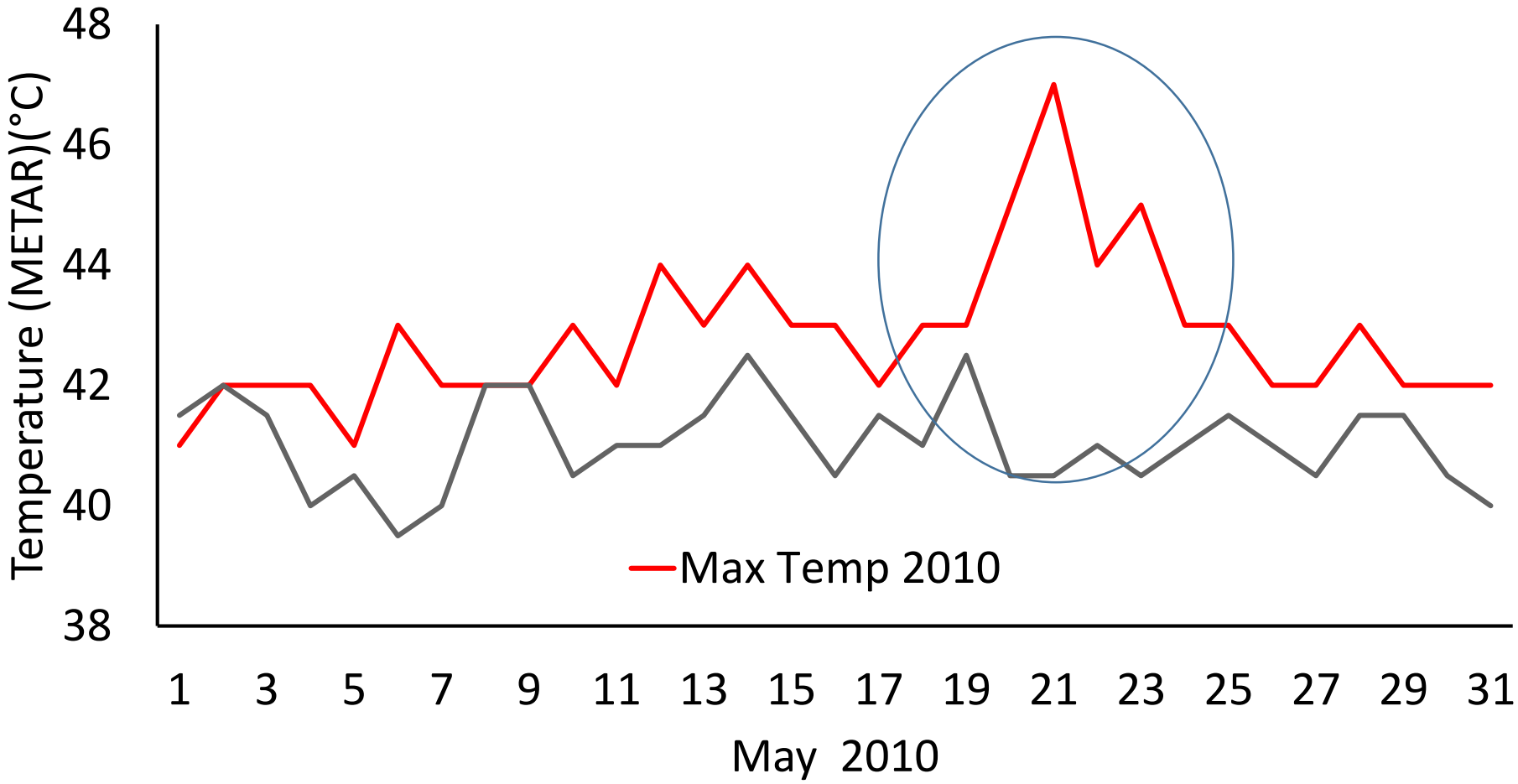
# Water shortage and heat in summer : deadly combination

# Reported Heat wave deaths are like tip of an icebergs -10% visible – 90% not visible



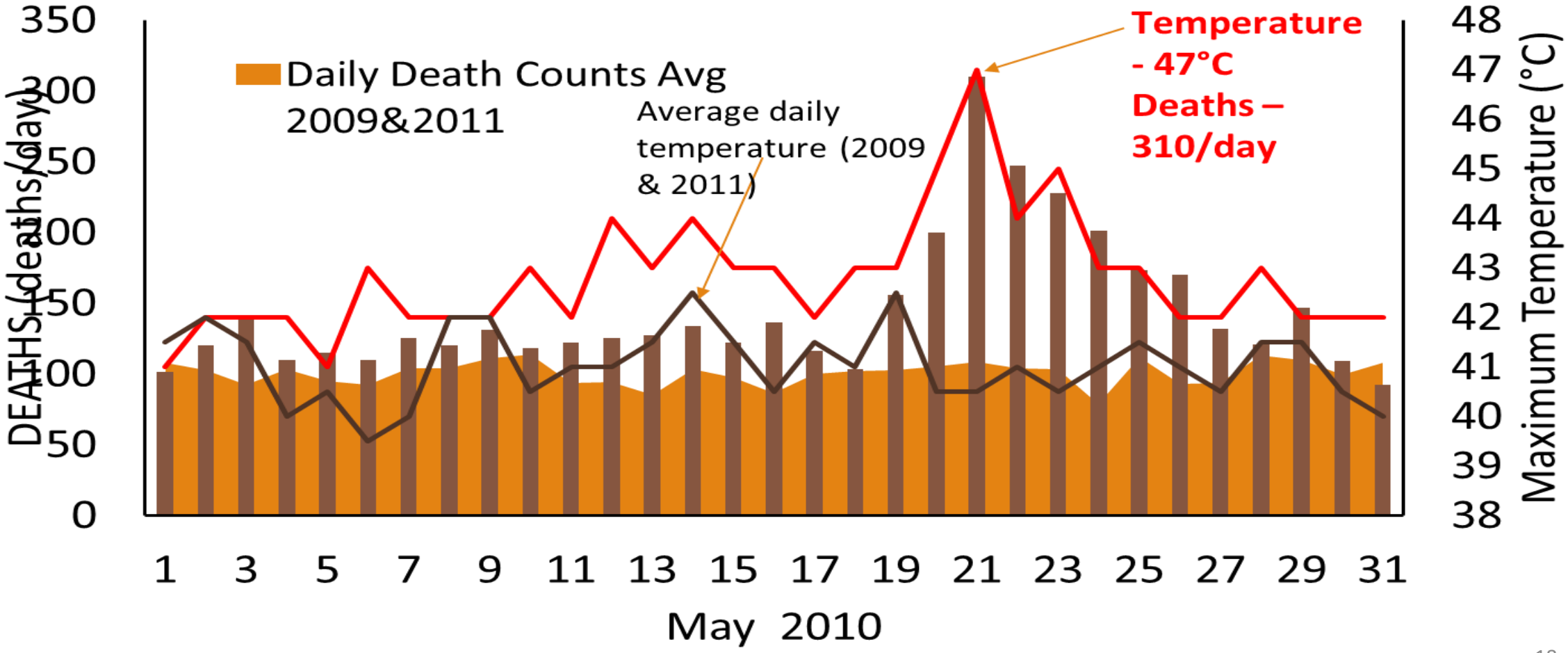
# Max temperature in May 2010 and 2009-2011 average : Ahemdabad city

2010 Heat wave in Ahmedabad – Temp. reached 47deg C on 21st May

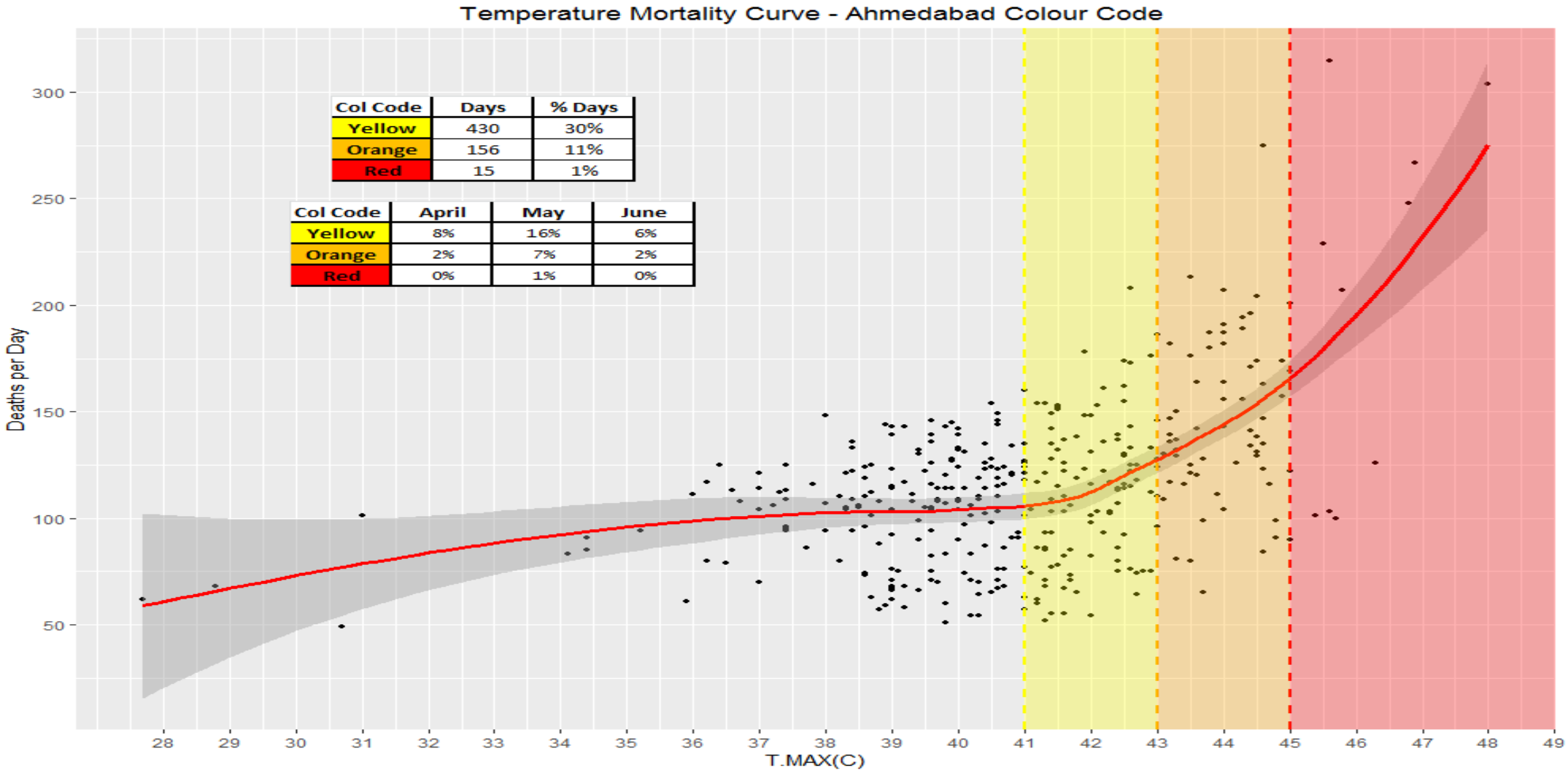


# 2010 Ahmedabad heat wave :

May 20-27th – excess deaths 800 in one week and 1344 excess deaths in May 2010.



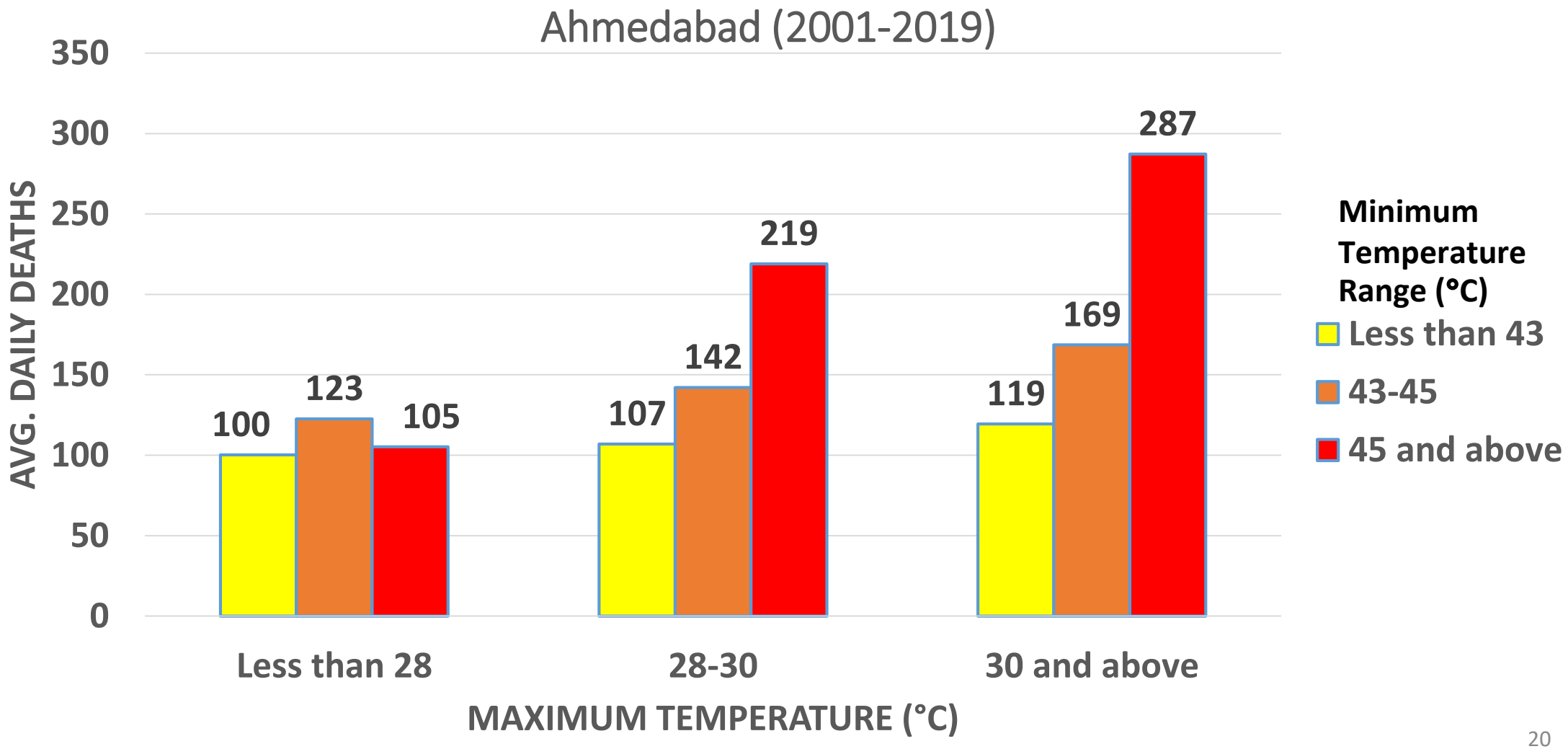
# Temperature Mortality scatter plot and fitted Curve – Setting the Thresholds




| Col Code | Days | % Days |
|---|---|---|
| Yellow | 430 | 30% |
| Orange | 156 | 11% |
| Red | 15 | 1% |

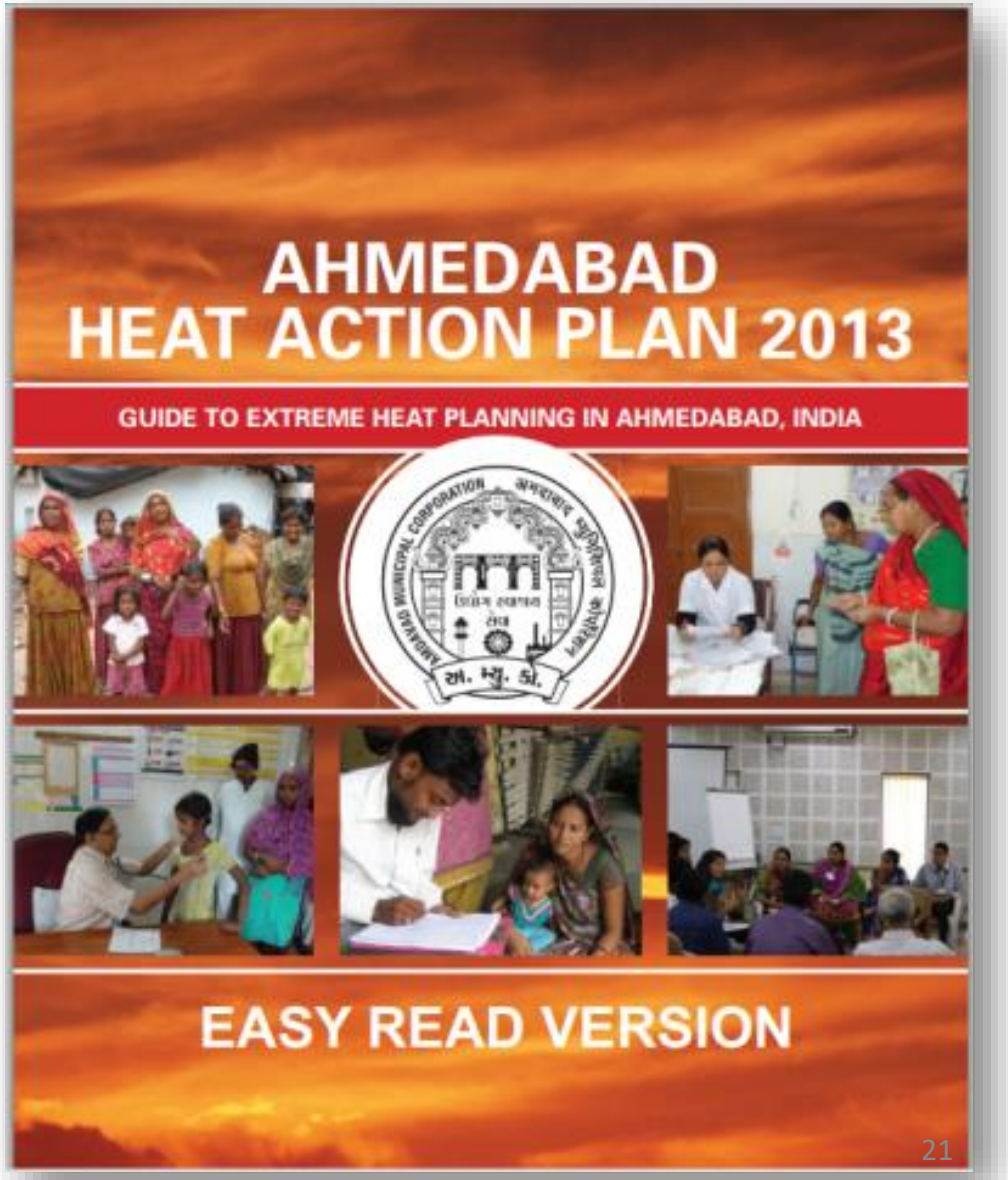
| Col Code | April | May | June |
|---|---|---|---|
| Yellow | 8% | 16% | 6% |
| Orange | 2% | 7% | 2% |
| Red | 0% | 1% | 0% |

# Min – Max Temperature and associated avg. daily death in Ahmedabad during summer (April to June)

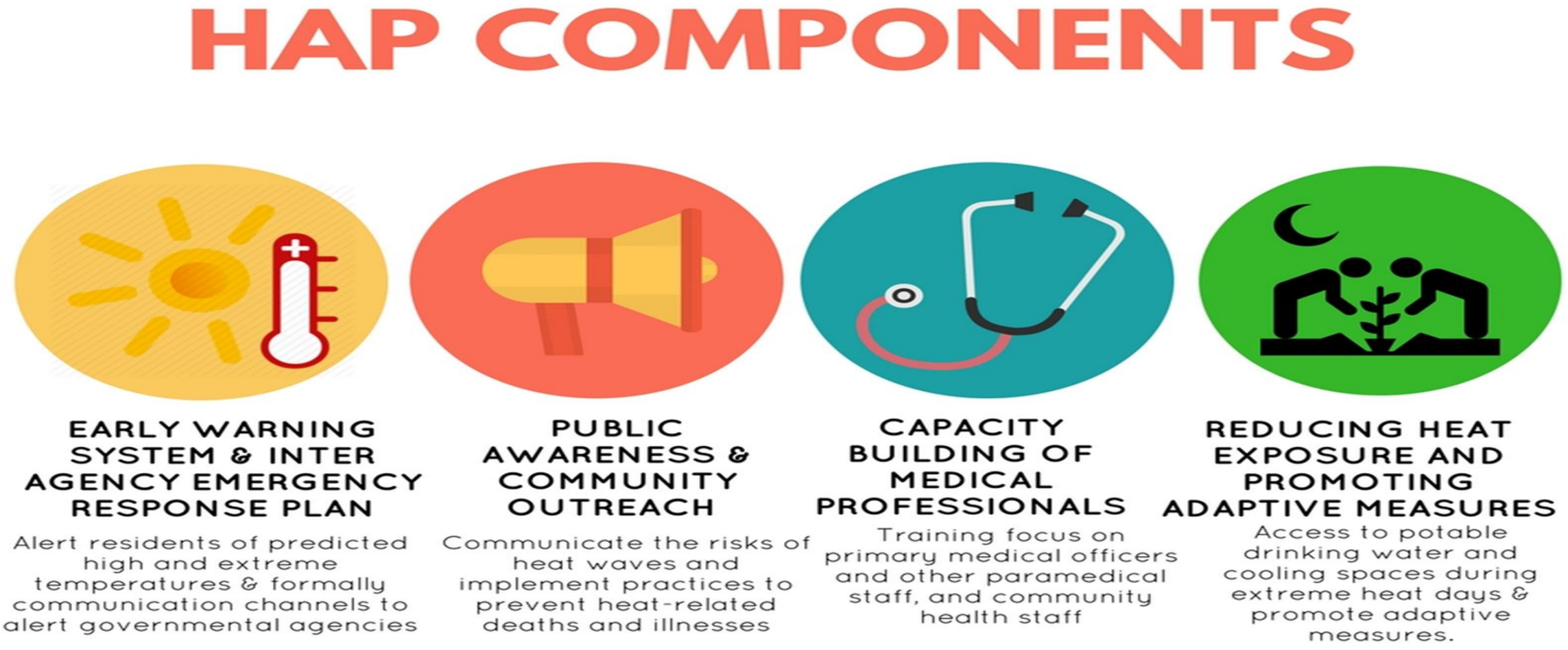


# Ahmedabad Heat Action Plan (HAP)

- Ahmedabad implemented South Asia's first heat action plan (HAP) after a 2010 heatwave.
- Cooperative effort of various partners – AMC, IIPHG, NRDC, IMD, and other partners
- Prepared from learning from HAPs from USA and Europe
- First Threshold based HAP
- Thresholds fixed based on mortality analysis



# Effective strategy for building resilience for vulnerable communities-HAP plan



# Intervention – 1

## *Early Warning System & Inter-Agency Emergency Response Plan*

भारत सरकार
पृथ्वी विज्ञान मंत्रालय
भारत मौसम विज्ञान विभाग
मौसम केंद्र,
आर एस/आर डब्ल्यु भवन,
हवाई अड्डा, अहमदाबाद-382, 475
फोन न. 079 22865012

Government of India
*Ministry of Earth Sciences*
India Meteorological Department
Meteorological Centre,
RS/RW Building, Airport,
Ahmedabad-382 475.
Phone: 079-22865012
Fax : 079-22865449

Issuing Office: Meteorological Centre, Ahmedabad
Time of Origin : 1200 Hrs. IST
Date : 27/04/2019
HAP20190427/01

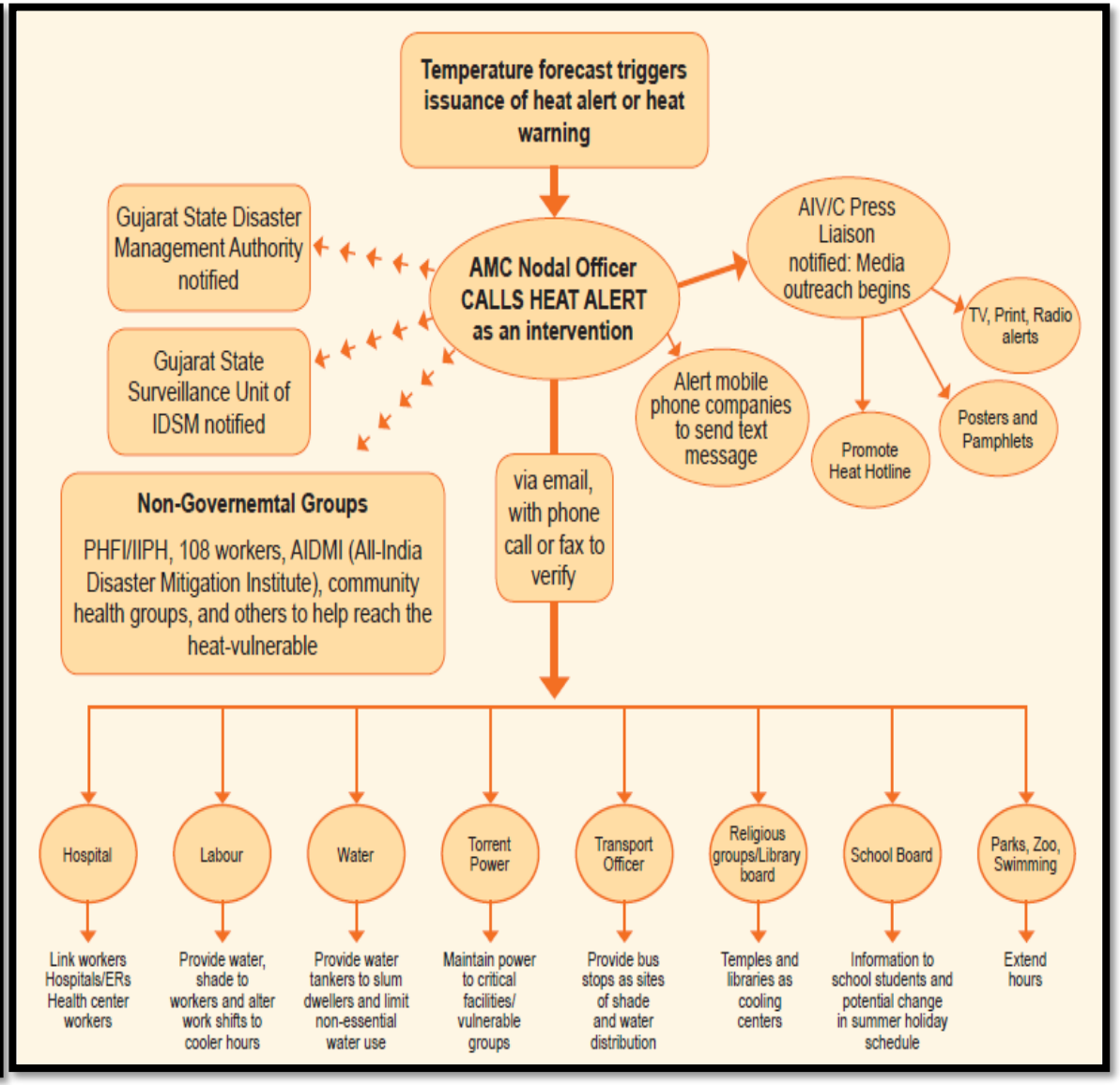
**Five days City weather forecast (Maximum temperature forecast) for Ahmedabad**

| Maximum Temperature forecast | Maximum temperature in deg Celsius | Probability of occurrences | High Temperature Warning |
|---|---|---|---|
| Day1 (Valid from time of origin to 0830 Hrs. IST of 28/04/2019 ) | 45 | Most likely | |
| Day2(Valid from 0830 Hrs. IST of 28/04/2019 to 0830 Hrs. IST of 29/04/2019 ) | 45 | Most likely | |
| Day3( Valid from 0830 Hrs. IST of 29/04/2019 to 0830 Hrs. IST of 30/04/2019 ) | 44 | Very likely | |
| Day4( Valid from 0830 Hrs. IST of 30/04/2019 to 0830 Hrs. IST of 01/05/2019 ) | 43 | Very Likely | |
| Day5( Valid from 0830 Hrs. IST of 01/05/2019 to 0830 Hrs. IST of 02/05/2019 ) | 42 | Likely | |

**Legend:** **Probability of occurrences**
Unlikely: less than 25 %
Likely: 25 to 50 %

**Levels:**
Yellow: 41.1- 43 deg Celsius
Orange: 43.1- 44.9 deg Celsius
Red: ≥45.0 deg Celsius

for Director In-charge
Meteorological Centre
Ahmedabad



# Intervention – 2

## *Public Awareness & Community Outreach*






# Community Outreach







# Public Awareness IEC videos on various themes

Click Here: https://ndma.gov.in/Resources/awareness/heatwave

Public awareness film
by
***National Disaster Management Authority, India.***

Technical support
by

INDIAN INSTITUTE OF PUBLIC HEALTH GANDHINAGAR

# Intervention – 3

## *Building Capacity of medical community*



### Case Definitions

#### Heat Illness - Typical Presentations

| Clinical Entity | Age Range | Setting | Cardinal Symptoms | Cardinal Signs | Pertinent Negatives | Prognosis |
|---|---|---|---|---|---|---|
| Heat rash | All, but frequently children | Hot environment; +/- insulating clothing or swaddling | Itchy rash with small red bumps at pores in setting of heat exposure; bumps can sometimes be filled with clear or white fluid | Diffuse maculopapular rash, occasionally pustular, at hair follicles; pruritic | Not focally distributed like a contact dermatitis; not confluent patchy; not petechial | Full recovery with elimination of exposure and supportive care |
| Heat cramps | All | Hot environment, typically with exertion, +/- insulating clothing | Painful spasms of large and frequently used muscle groups | Uncomfortable appearance, may have difficulty fully extending affected limbs/joints | No contaminated wounds/tetanus exposure; no seizure activity | Full recovery with elimination of exposure and supportive care |
| Heat exhaustion | All | Hot environment; +/- exertion; +/- insulating clothing or swaddling | Feeling overheated, lightheaded, exhausted and weak, unsteady, nauseated, sweaty and thirsty, inability to continue activities | Sweaty/diaphoretic; flushed skin; hot skin; normal core temperature; +/- dazed, +/- generalized weakness, slight disorientiation | No coincidental signs and symptoms of infection; no focal weakness; no aphasia/dysarthria; no overdose history | Full recovery with elimination of exposure and supportive care; progression if continued exposure |
| Heat syncope | Typically adults | Hot environment; +/- exertion; +/- insulating clothing or swaddling | Feeling hot and weak; lightheadedness followed by brief loss of consciousness | Brief, generalized loss of consciousness in hot setting, short period of disorientation if any | No seizure activity, no loss of bowel or bladder continence, no focal weakness, no aphasia/dysarthria | Full recovery with elimination of exposure and supportive care; progression if continued exposure |
| Heat stroke | All | Hot environment; +/- exertion; +/- insulating clothing or swaddling | Severe overheating; profound weakness; disorientation, obtundation, seizures, or other altered mental status | Flushed, dry skin (not always), core temp ≥40°C; altered mental status with disorientation, possibly delirium, coma, seizures; tachycardia; +/- hypotension | No coincidental signs and symptoms of infection; no focal weakness; no aphasia/dysarthria; no overdose history | 25-50% mortality even with aggressive care; significant morbidity if survive |

# Activities of UHCs under Ahmedabad Heat Action Plan

Management of Heat Illnesses at UHC
& Referral to Higher Health Centres


**Heat Illness – Treatment Protocol**

Recognizing that treatment protocols may vary slightly according to the setting (EMS, health center, clinic, hospital emergency department, etc.), the following should apply generally to any setting and to all patients where there is a potential concern for heat illness. Special thanks to Drs. Arthur Yancey and Nee-Kofi Mould-Millman of Grady Emergency Medical Services, Emory University Department of Emergency Medicine, Atlanta, GA USA

1. Initial patient assessment – primary survey (airway, breathing, circulation, disability, exposure), vital signs, including temperature
2. Consider heat illness in differential diagnosis if:
    a. Presenting with suggestive symptoms and signs (see table)
    b. Patient has one or more of the following risk factors:
        i. Extremes of age (infants, elderly)
        ii. Debilitation/physical deconditioning, overweight or obese
        iii. Lack of acclimatization to environmental heat (recent arrival, early in summer season)
        iv. Any significant underlying chronic disease, including psychiatric, cardiovascular, neurologic, hematologic, obesity, pulmonary, renal, and respiratory disease
        v. Taking one or more of the following:
            1. Sympathomimetic drugs
            2. Anticholinergic drugs
            3. Barbiturates
            4. Diuretics
            5. Alcohol
            6. Beta blockers
3. Remove from environmental heat exposure and stop physical activity
4. Initiate passive cooling procedures
    a. Cool wet towels or ice packs to axillae, groin, and around neck; if patient is stable, may take a cool shower, but evaluate risk of such activity against gain and availability of other cooling measures
    b. Spray cool water or blot cool water onto skin
    c. Use fan to blow cool air onto moist skin
5. If temperature lower than 40°C, repeat assessment every 5 minutes; if improving, attempt to orally hydrate (clear liquids, ORS can be used but not necessary; cool liquids better than cold)and observe
6. If temperature 40°C or above, initiate IV rehydration and immediately transport to emergency department for stabilization

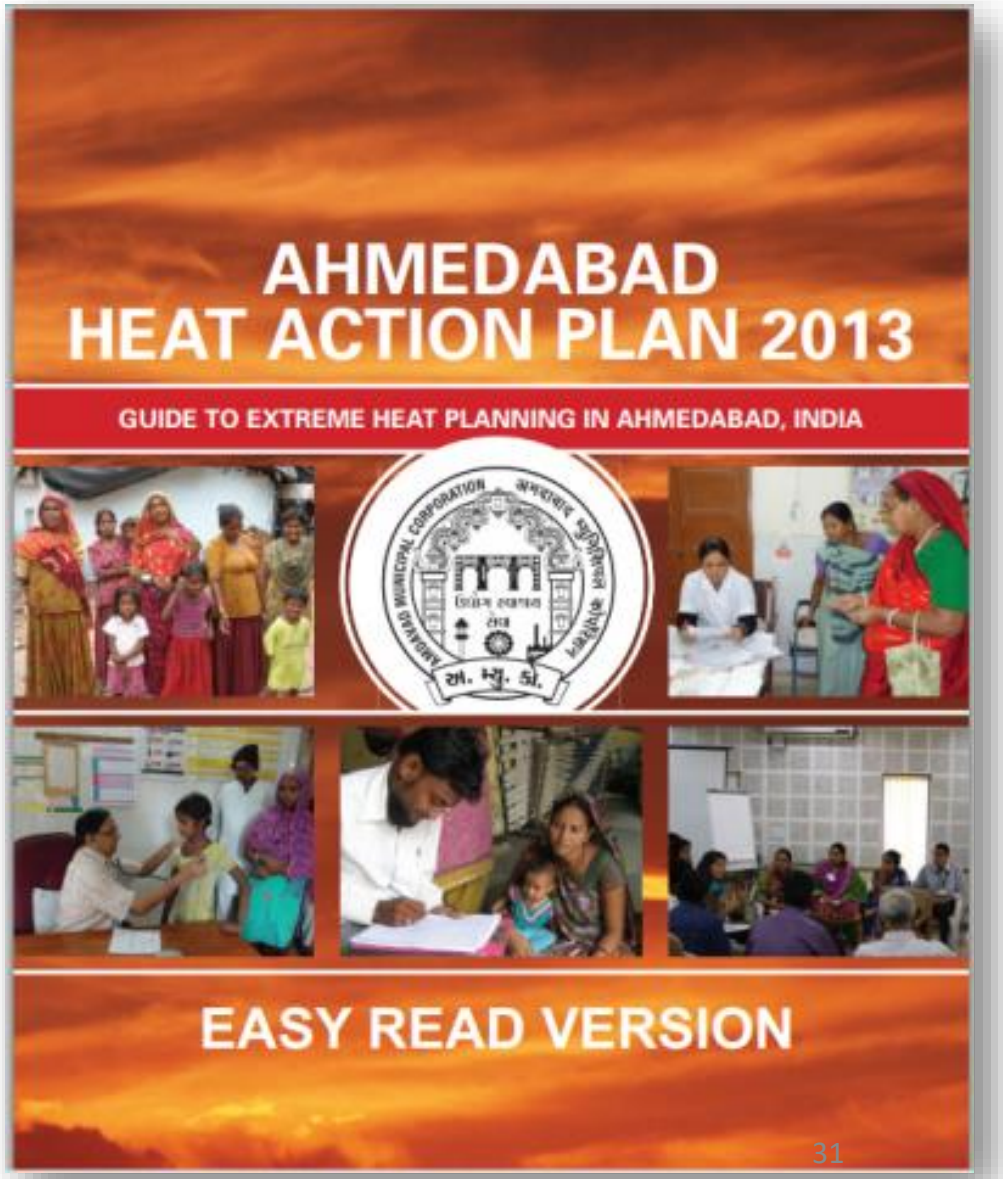
# Intervention – 4 *Reducing Heat Exposure & Promoting Adaptive Measures – Drinking water, cooling centers*

# Ahmedabad and Telangana Cool Roofs Program

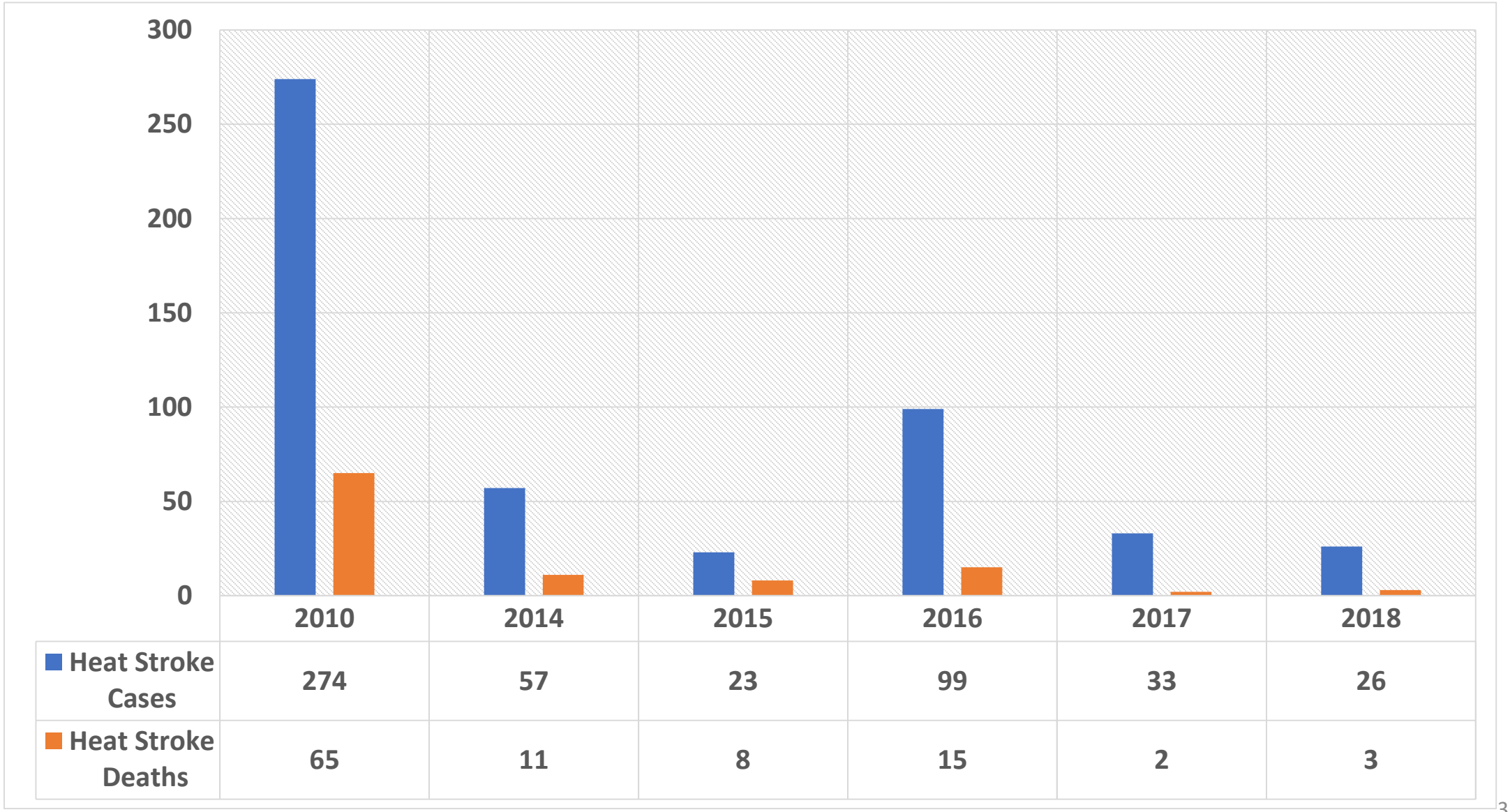
- In 2017 and 2018, the cities of Ahmedabad and Hyderabad initiated pilot cool roof programs.
- In Telangana, MAUD and GHMC piloted the cool roofs program focused on 25 low-income households.
- In 2017, AMC unveiled a cool roofs initiative as a part of the updated Ahmedabad Heat Action Plan 2017
  - Converted 3000 homes to cool roofs with lime paint
  - Company manufacturing heat reflective paint donated to paint 10-15 pilot households,
  - Dedicated IEC materials on cool roofs developed to increase community awareness
- ***2019 Telangana circulated the draft cool roof policy: target- kick start with 11,000 sq ft in 2021. Policy to be released***
- ***Ahmedabad through the HAP announced in 2020 target to cool roofs 15,000 slum roofs and 1000 AMC building roofs. To be completed in 2021***

# Impact of Ahmedabad Heat Action Plan (HAP)

- Reduction in all-cause mortality
- Decrease in heat stroke cases &  death
- The pre-HAP Relative Risk of mortality was 2.34 post-HAP RR was 1.25 estimated at 47°C.
- Estimated 1,190 (95%CI 162–2,218) average annualized deaths were avoided in the post-HAP period. *(Source: Hess et al., 2018)*

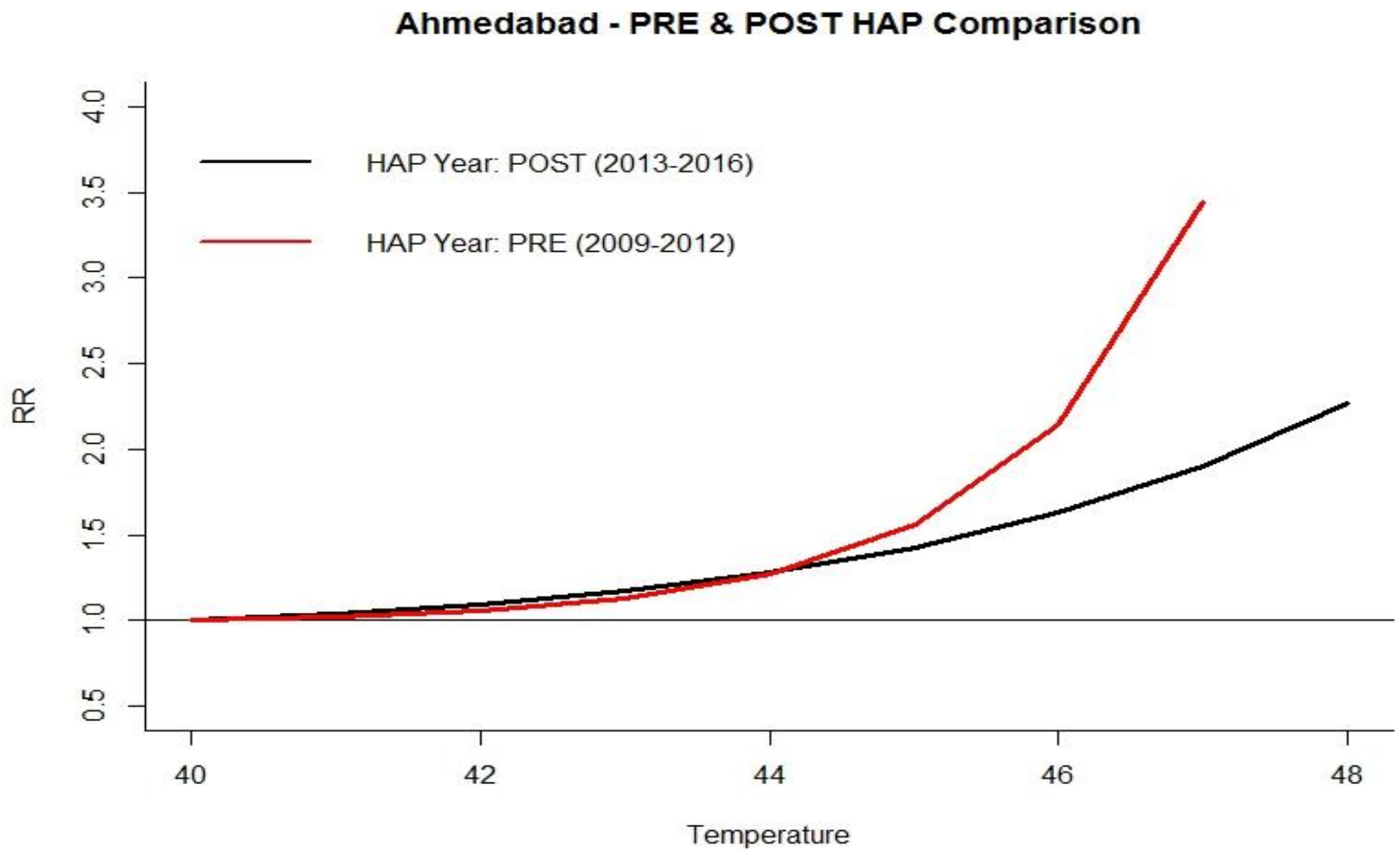


# Year wise Heat Stroke cases




| | 2010 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|
| Heat Stroke Cases | 274 | 57 | 23 | 99 | 33 | 26 |
| Heat Stroke Deaths | 65 | 11 | 8 | 15 | 2 | 3 |

# Relative Risk of Death with max temperature – Ahmedabad Pre & Post HAP



# 8th Earth Care Award 2018 for our pioneer work in Ahmedabad HAP


# EXPANDING HEAT RESILIENCE ACROSS INDIA with help from National Disaster Management Authority

- In 2019, the national government is working with 23 states and over 100 cities and districts to implement and develop heat action plans in India.

- IMD continues to provide daily temperature forecasts to over 350 cities.

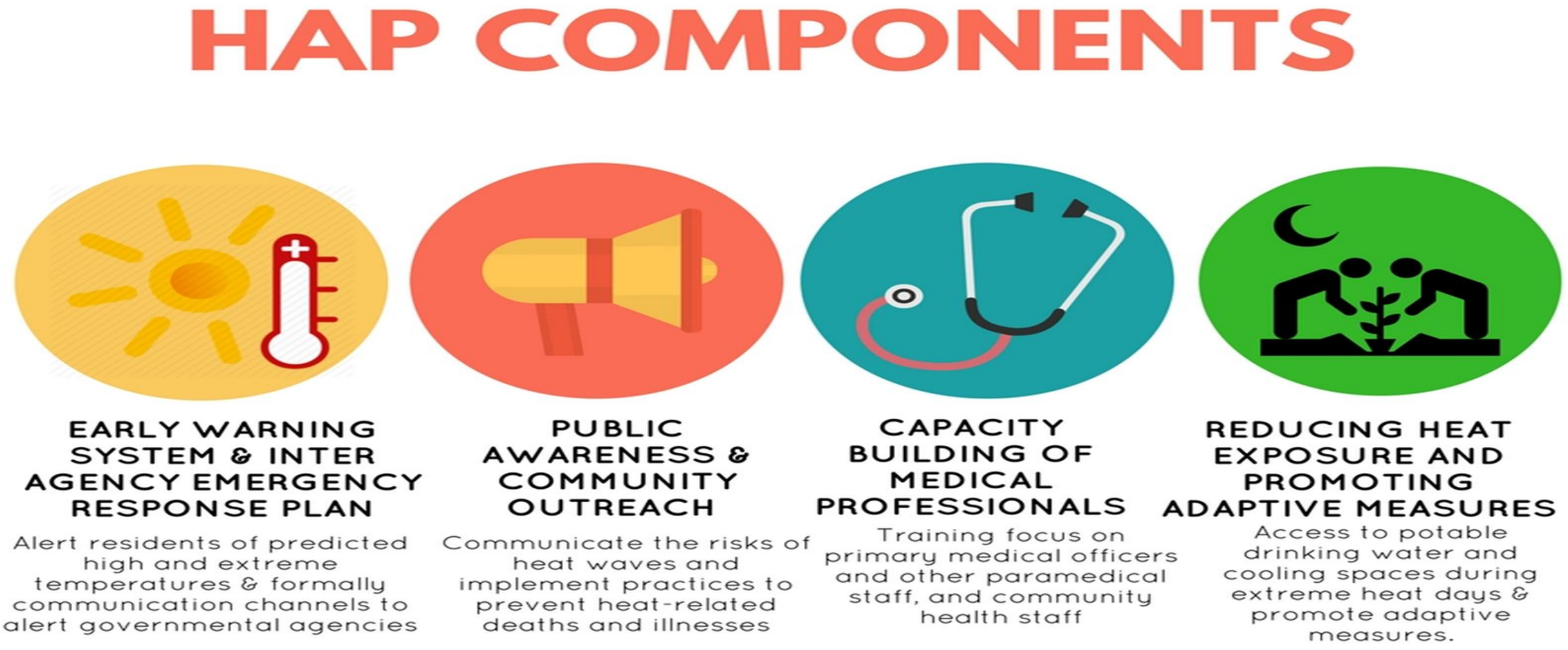
# Key Lessons for success of HAP

- **Involvement of Local city or district administrative and health and political leadership – Mayor, commissioner, health officer, publicity off.**
- **Engagement with all stakeholders: IMD for weather data, Health data for analysis, city govt for various actions, NGOs, communities .**
- **Facilitation by local and national institutions / experts – universities**
- **Learning from HAP in  other countries / cities**
- **Setting up SOPs and making HAP part of Disaster Planning for states**
- **Importance of recording and analysing causes of death, mortality and morbidity data**
- **Measurement of process of implementation and Impact on mortality and morbidity**
- **Adequate funding and linkage with national / international agencies.**

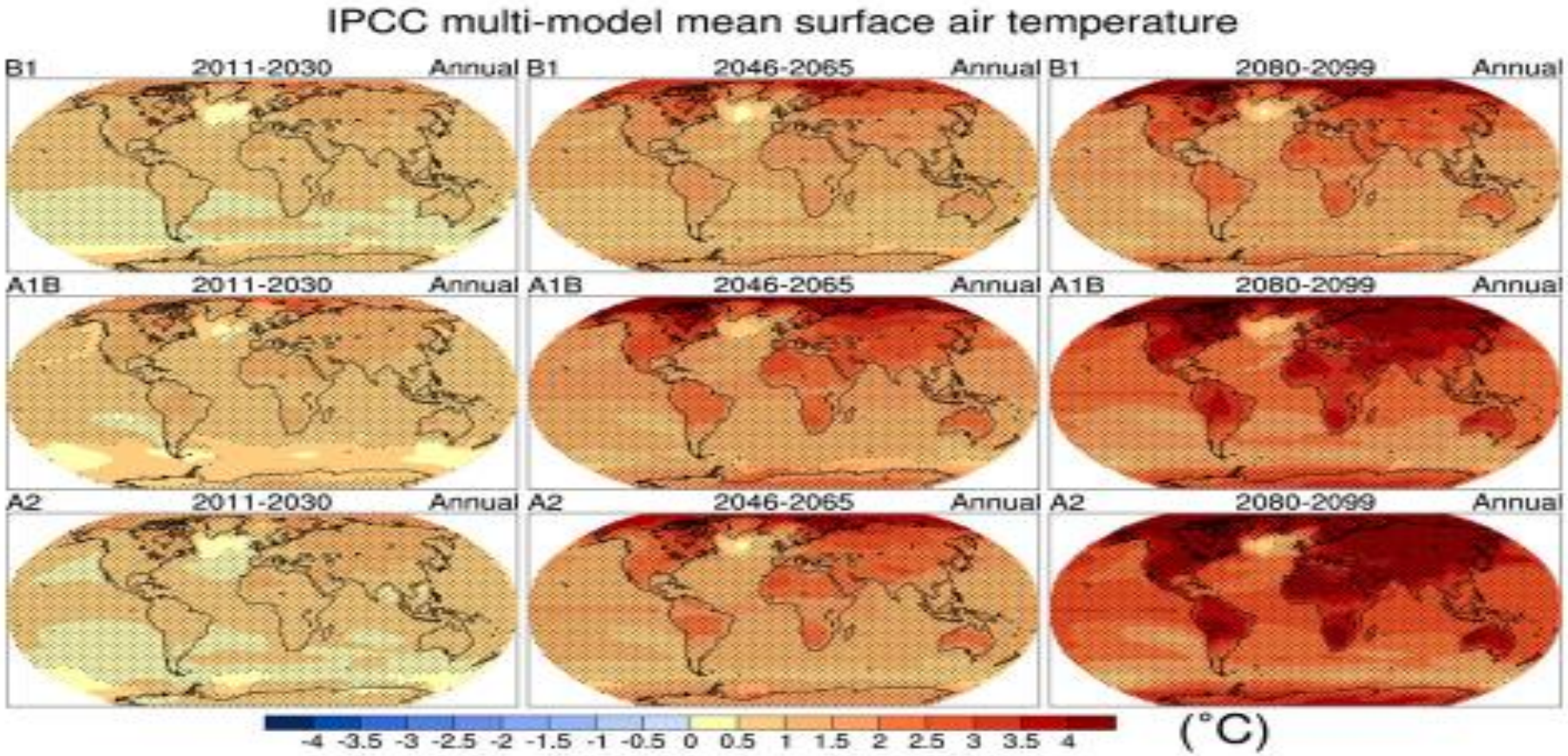
# Issues and challenges remain

- Many state and city leaders/administrators have not yet see the link between environment and health – esp heat waves and mortality
- The connection between climate change and rising temperatures and heat-related illnesses not well understood by municipal administrators
- No environmental health dept in municipality, district, state or national level – not prioritized
- Town planning and civil engineering / architects not yet fully on board for Cool roof program implementation
- More research at local levels is needed to build evidence and strengthen information system – better data on mortality and morbidity needed.

# Effective strategy for building resilience for vulnerable communities-HAP plan



# This is the beginning of climate change – worse still to come – so lets prepare now for next 80 years







# Thank You to all the partners

# Thanks from IIPHG for the opportunity