



# Heat early warning systems in a warming world

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Red Cross Red Crescent Climate Centre



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# Why we need heat early warning systems

- Extreme heat is one of the fastest-growing climate risks worldwide
- **Heat EWS are crucial mechanisms to signal dangerous heat and trigger action**
- Scaling up heat EWS worldwide is estimated to save nearly 100,000 lives per year (WMO, 2025)



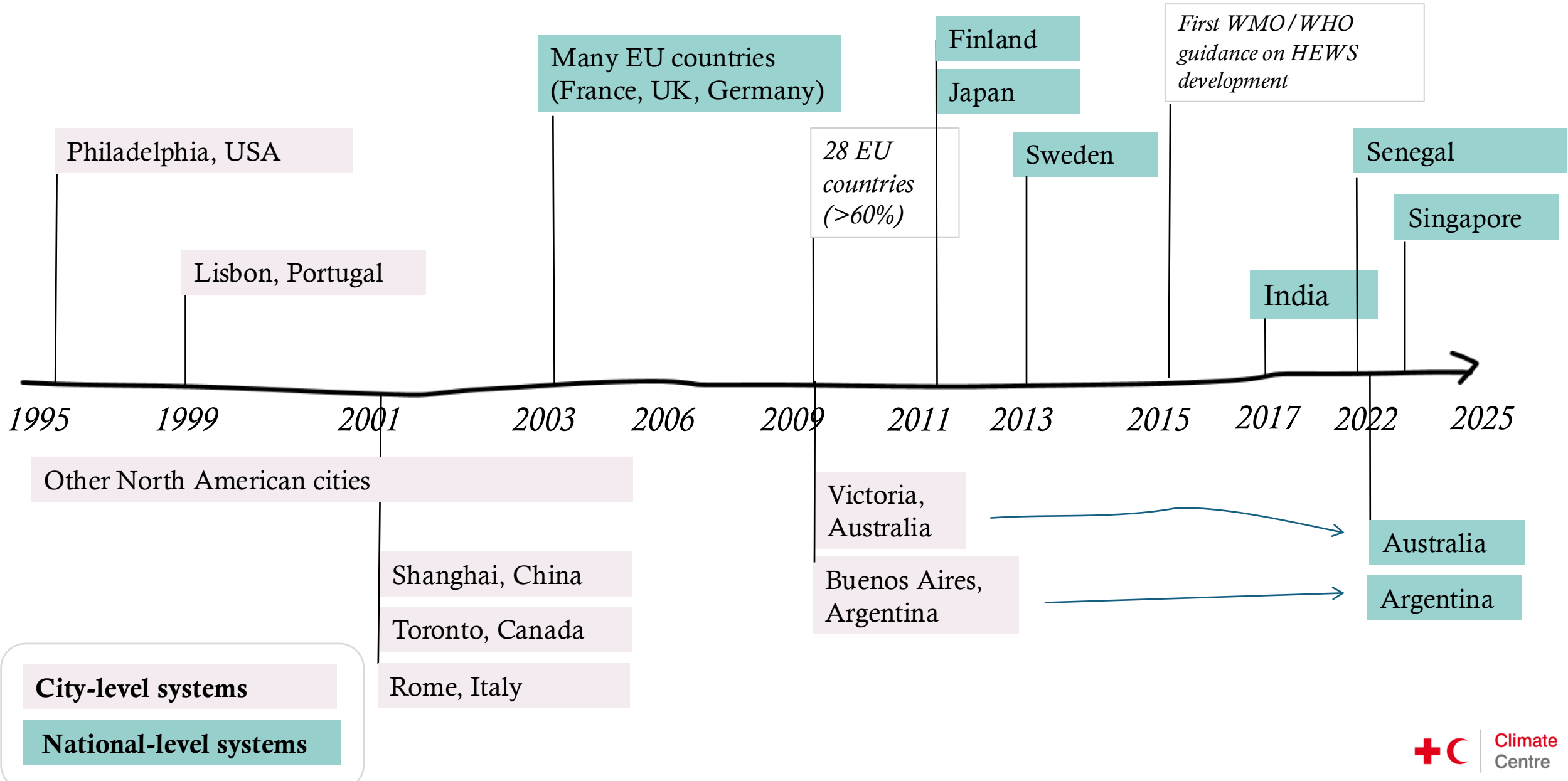
In the 2017 Pakistan heatwave, Dr. Seemi Jamali, head of emergencies at a Medical Centre in Karachi, said:

***"the warning gave time to stock extra medicine, set aside beds and put medical staff on high alert [..] avoiding possible deaths"***

# What is a warning system?



# A brief history of heat early warning systems



# Many heat warning systems were developed **due to demand from the health sector**



- Many systems were developed after deadly heatwaves
- Thresholds sometimes (co-)developed by health authorities (heat-health warning systems)

# Which types of heat EWS exist?



Extreme temperature or heatwave  
(temperature-based) warning systems

## *Example*

Based on air temperature (Tmax  
and/or Tmin)  
*e.g. 3 days > 40 °C*



Thermal (weather) warning systems

Based on thermal stress indicators  
(WBGT, Heat Index, etc.)  
*e.g. 1 day > 30°C WBGT*



Heat-health warning systems

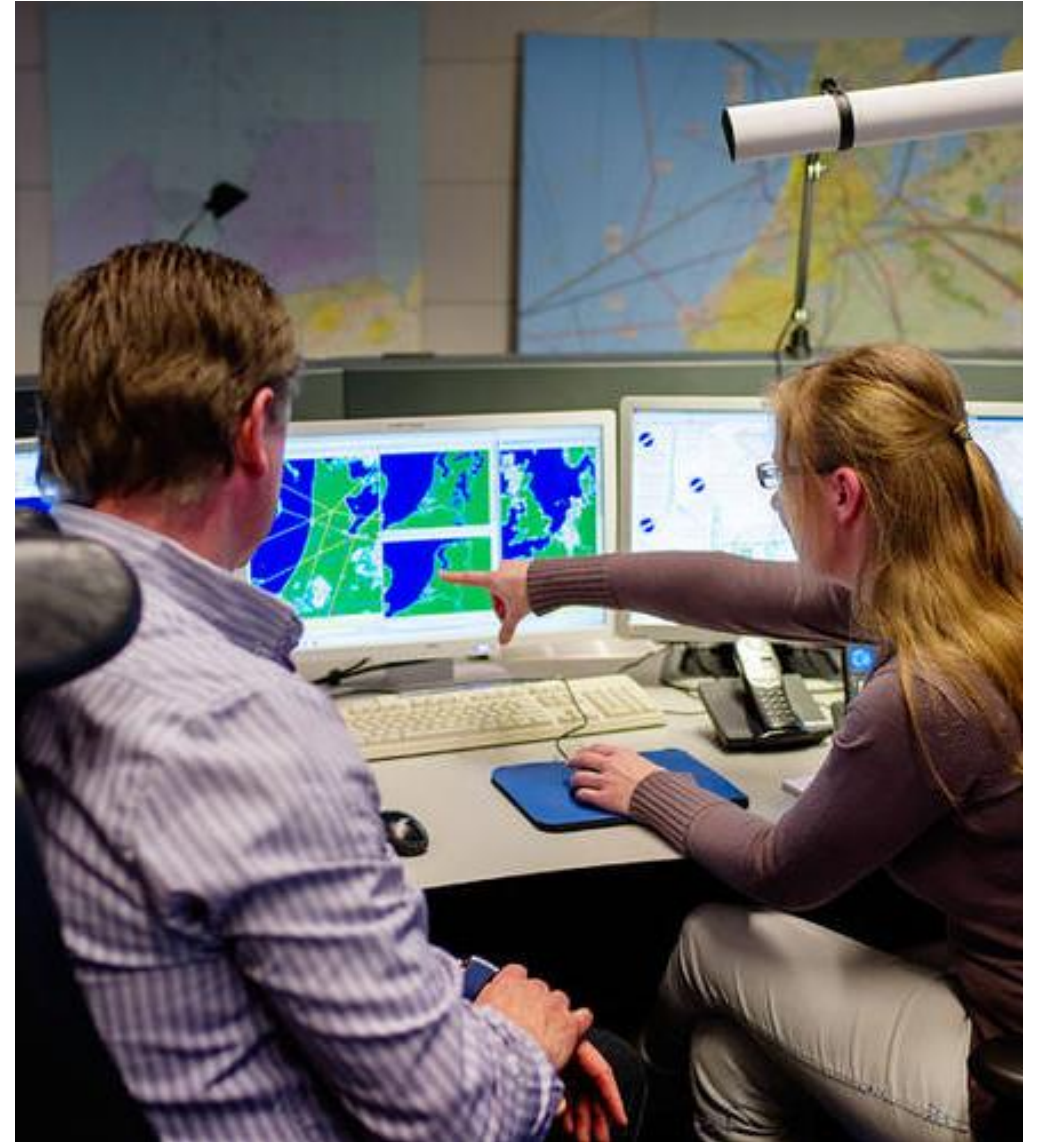
Link weather conditions to  
observed health impacts  
*e.g. 2 days above 30°C  
associated with >10% excess  
mortality*

# Extreme heat is deadly, but it's predictable

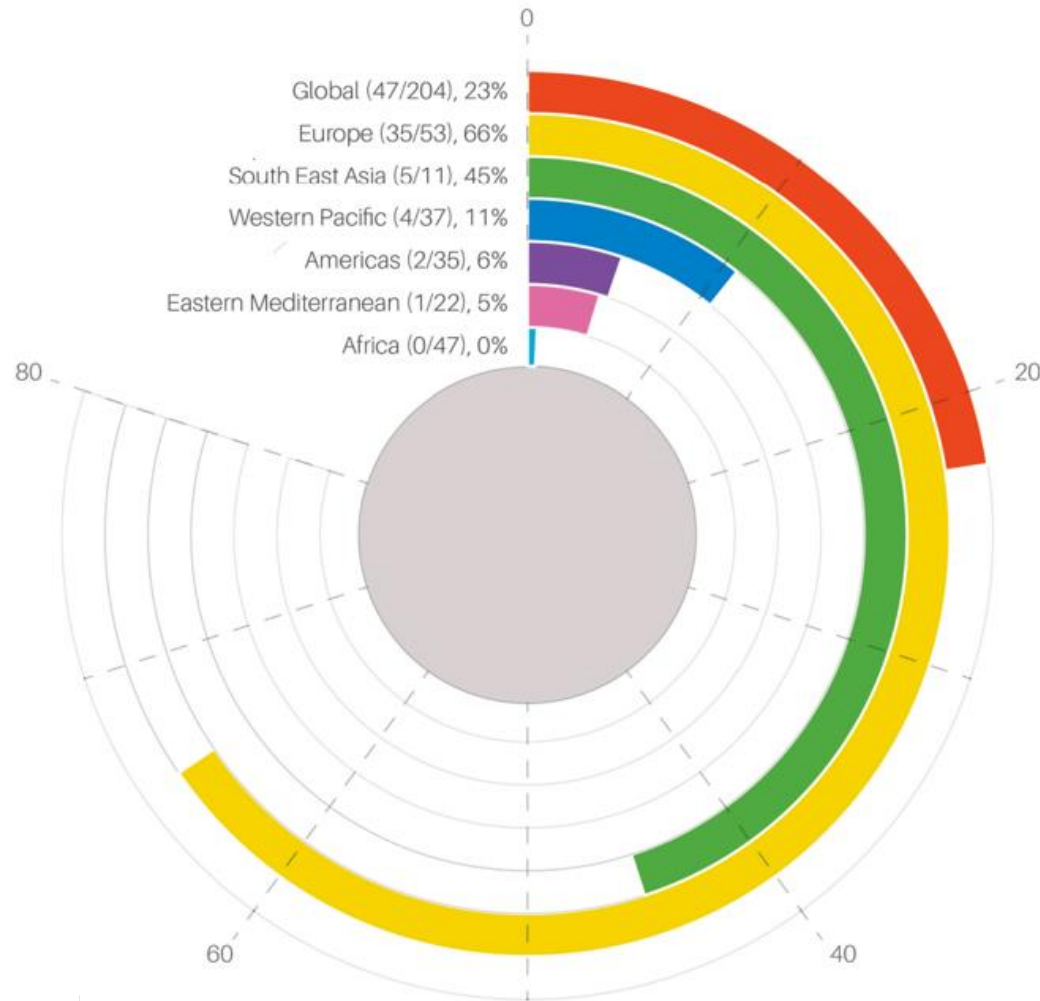
**Temperature** is the most predictable meteorological variable

Regional differences in skill, but generally very accurate worldwide up to 3-10 days

Humidity, wind, are less accurate further in advance



# From heat warnings to action



## Heat early warning systems are most effective when embedded within broader Heat Action Plans (HAPs/HHAPs)

- However, many countries still lack formal Heat Action Plans
- In some countries, humanitarian actors have stepped in through anticipatory action and *Early Action Protocols (EAPs)*

# Example: heat-health warnings in Senegal

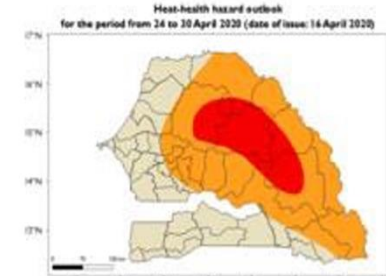
**WEEK 2**

**Heat – Health Early Warning Bulletin**

**BULLETIN N°: 001**      DATE OF ISSUE: 16 APRIL 2020  
VALIDITY PERIOD: 24 – 30 APRIL 2020

**HEALTH IMPACTS OF HEAT WAVE**

Heat-health hazard outbreak for the period from 24 to 30 April 2020 (date of issue: 16 April 2020)



**Legend**

LEVEL OF ALERT	ALERT	HEALTH IMPACTS
Extremely dangerous	Heat strokes for the entire population	Possible aggravation of cardiovascular and pulmonary diseases
Dangerous	Heat strokes for heat sensitive population	Fainting, severe dehydration, cramps, fatigue
Very uncomfortable	Care required for heat sensitive population	Dehydration, headache, dizziness, confusion
Watch		Negligible


**WEEK 2**

**HEALTH SITUATION FOR THE PERIOD FROM 24 TO 30 APRIL 2020**

Extremely high temperatures are expected in the eastern part of Senegal during the period from 24 to 30 April 2020 (see annex).

Heat stroke and heat discomfort will probably occur in the following regions: St. Louis, Matam, Louga, Diourbel, Kaffrine, Tambacounda and Kédougou. A regular follow-up of vulnerable people is recommended, especially in the regions of Matam, the northern part of Tambacounda and Goudiry, as well as the south and eastern portions of Kanel and Linguère.

**THE MOST VULNERABLE PEOPLE TO HEAT WAVES**



**FIRST AID**

- Find help if you feel dizzy, weak, and anxious, feel very thirsty, and have headaches or painful muscle spasm.
- Find a cool place as quickly as possible and take your temperature.
- Drink water to rehydrate yourself.
- Get medical assistance if cramps last for more than an hour. See your doctor if you experience any unusual symptoms or if symptoms persist.

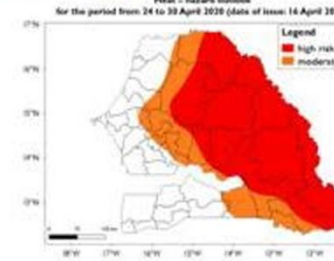
**In case of MALAISE or URGENCY, call: 15 15**

National Committee on Climate and Health – Heat-health early warning bulletin  
Direction Générale de la Santé – Email: [dg@dirg.senegal.gov.sn](mailto:dg@dirg.senegal.gov.sn) / Phone: +221 33 869 42 97  
ANACIM – Email: [anacim@anacim.sn](mailto:anacim@anacim.sn) / Phone: +221 33 865 60 60

**WEEK 2**

**ANNEX – HEAT RISKS**

Heat – hazard outlook for the period from 24 to 30 April 2020 (date of issue: 16 April 2020)



**METEOROLOGICAL SITUATION FOR THE PERIOD FROM 24 TO 30 APRIL 2020**

The atmospheric conditions will favor hot and dry air in the eastern half of Senegal during the period from 24 to 30 April 2020. There is an increased chance for heat wave in Matam, Podor, Linguère, Bakel, Kanel, Goudiry, Saraya, and the northern and eastern portions of Tambacounda and Kédougou.

**WHAT IS A HEAT WAVE?**  
A heat wave is defined as a period of abnormal hot and dry weather or hot and humid weather that persists during at least three consecutive days.

HOT AND DRY HEAT WAVE	HOT AND HUMID HEAT WAVE
The daily maximum temperature exceeds the 95 <sup>th</sup> percentile during at least three consecutive days.	The daily heat index is greater than 40°C during at least three consecutive days. The heat index expresses the sensation of heat felt by the human body as a function of air temperature and humidity.

National Committee on Climate and Health – Heat-health early warning bulletin  
Direction Générale de la Santé – Email: [dg@dirg.senegal.gov.sn](mailto:dg@dirg.senegal.gov.sn) / Phone: +221 33 869 42 97  
ANACIM – Email: [anacim@anacim.sn](mailto:anacim@anacim.sn) / Phone: +221 33 865 60 60

- Since 2022, Senegal has issued operational heat-health bulletins
- Warnings use region-specific thresholds (maximum temperature and Heat Index)
- Heat maps are overlaid with vulnerability maps to support targeted action
- Bulletin is designed to be accessible and visual

The bulletin is co-produced by ANACIM (meteorological service), the Ministry of Health, and the Ecological Monitoring Centre, distributed via the media and social networks with the support of the Senegalese Red Cross at community level

# The heat-health bulletin has led to:

- football teams adjusting training schedules to avoid peak heat
- shepherds limiting herd movement during the hottest periods
- schools planning breaks, early closures, and water distribution
- health services improving readiness to support vulnerable groups





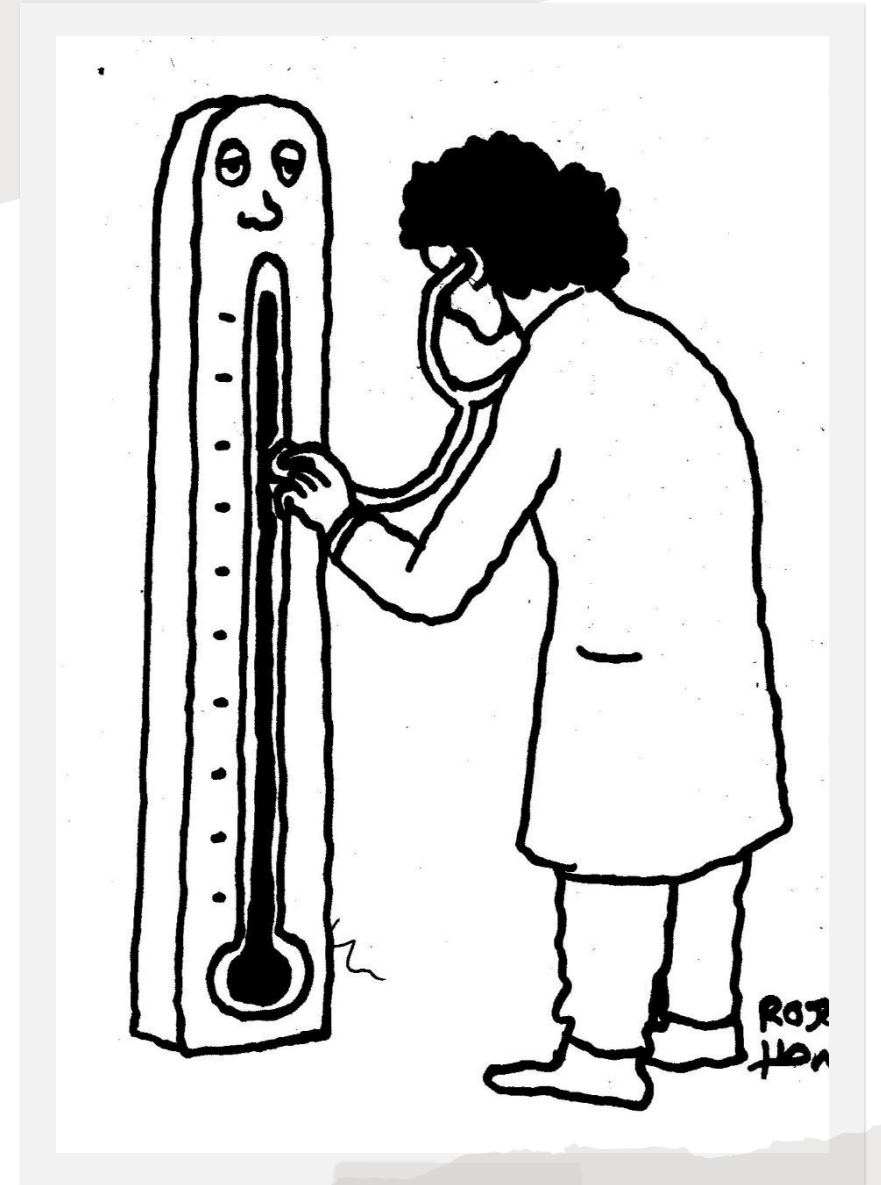
## Evaluation of the bulletin

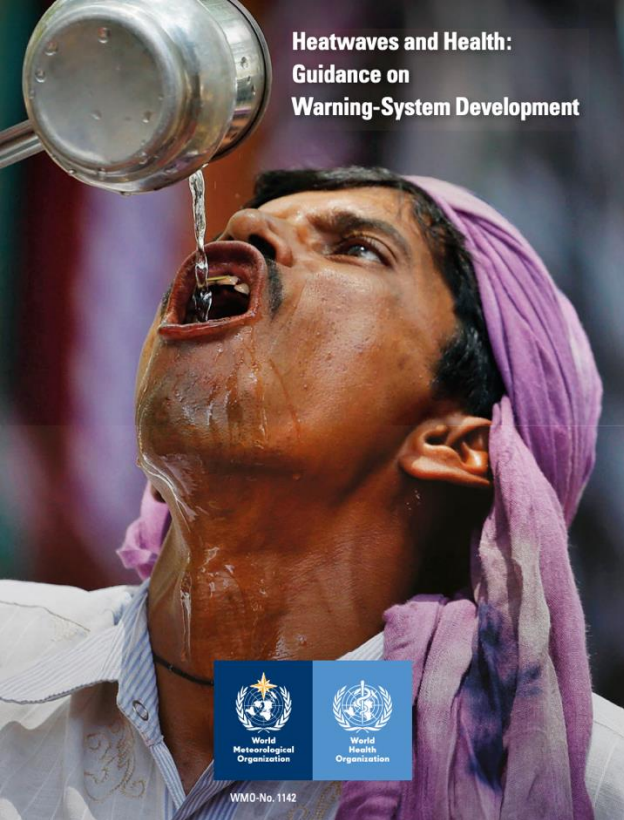
In 2023, Senegalese Red Cross volunteers conducted surveys with approximately 600 respondents in the Fatick region across farms, restaurants, public transport, health facilities, and households.

Following feedback from farmers, **voice recordings** were introduced

# Strengthening heat early warnings

1. **Knowledge:** We need stronger local evidence on heat-health relationships and other impacts such as livelihoods, labour, infrastructure, and shelters
2. **Forecasts:** Forecasting heat is often not the main challenge, temperature is the most predictable meteorological variable
3. **Communication:** Heat risk perception may be low, digital channels may be compromised during heat, need for simple, trusted messaging through multiple channels to reach everyone
4. **Response & plans:** Heat warnings should trigger concrete protective measures through Heat Action Plans (HAPs), which still need to expand worldwide





warning systems

13 April, 2026



## HEATWAVE GUIDE FOR CITIES

### Campaign Materials

<p><b>Heat Risk Communication Strategies</b> Evidence-based guidance on designing heat messages that motivate communities to act.</p> <p><a href="#">Click here</a></p>	<p><b>Heat Action Videos</b> Available in Bengali, English, and Nepali.</p> <p><a href="#">Click here</a></p>
<p><b>Heat Action Social Media</b> Available in Bengali, English, and Nepali.</p> <p><a href="#">Click here</a></p>	<p><b>Heat Action Posters</b> Available in Bengali, English, Nepali, and generic format.</p> <p><a href="#">Click here</a></p>



# More information

- ZCRA/RCCC work on heat early warnings
  - **Report** “Understanding The Global Landscape Of Heat Early Warning Systems” coming soon – *June!*
  - **8 case-studies:** Mexico, Jordan, Senegal, Pakistan, Nepal, Bangladesh, Vietnam, Philippines – coming later this year!
- WMO/WHO guidance on heat warning system development:
 

<https://www.who.int/publications/m/item/heatwaves-and-health--guidance-on-warning-system-development> (updated one coming soon) + *Handbook of Extreme Heat Indicators, Indices, and Metrics*
- RCCC Heat Toolkit:
 

<https://preparecenter.org/toolkit/heat/>
- ZCRA Urban/Heat Resource Library:
 

<https://zcralliance.org/resources-urban-heat/>
- GHHIN: <https://ghhin.org/>