

# Heat Health for a Climate Resilient ASEAN

Jason KW LEE

Director, Heat Resilience & Performance Centre  
Chair, WHO-WMO GHHIN SE Asia Heat Health Hub



**NUS**  
National University  
of Singapore

National University of Singapore

# EXTREME HEAT AND SOCIO-ECONOMIC DISPARITIES

## Case Study: Shoemaking factory in Vietnam (Project HeatSafe)





**“The era of global  
boiling has arrived.”**

United Nations Secretary-General

António Guterres

July 2023



Under EMBARGO until 12:30 p.m. EDT on Thursday, 25 July 2024

# United Nations Secretary-General's Call to Action on Extreme Heat



## Ensuring safety and health at work in a changing climate

Global report

# The 2024 report of the Lancet Countdown on health and climate change: facing record-breaking threats from delayed action



Marina Romanello, Maria Walawender, Shih-Che Hsu, Annalyse Moskeland, Yasna Palmeiro-Silva, Daniel Scamman, Zakari Ali, Nadia Ameli, Denitsa Angelova, Sonja Ayeb-Karlsson, Sara Basart, Jessica Beagley, Paul J Beggs, Luciana Blanco-Villafuerte, Wenjia Cai, Max Callaghan, Diarmid Campbell-Lendrum, Jonathan D Chambers, Victoria Chicmana-Zapata, Lingzhi Chu, Troy J Cross, Kim R van Daalen, Carole Dalin, Niheer Dasandi, Shouro Dasgupta, Michael Davies, Robert Dubrow, Matthew J Eckelman, James D Ford, Chris Freyberg, Olga Gasparyan, Georgiana Gordon-Strachan, Michael Grubb, Samuel H Gunther, Ian Hamilton, Yun Hang, Risto Hänninen, Stella Hartinger, Kehan He, Julian Heidecke, Jeremy J Hess, Louis Jamart, Slava Jankin, Harshavardhan Jatkar, Ollie Jay, Ilan Kelman, Harry Kennard, Gregor Kiesewetter, Patrick Kinney, Dominic Kniveton, Rostislav Kouznetsov, Pete Lampard, Jason K W Lee, Bruno Lemke, Bo Li, Yang Liu, Zhao Liu, Alba Llabrés-Brustenga, Melissa Lott, Rachel Lowe, Jaime Martinez-Urtaza, Mark Maslin, Lucy McAllister, Celia McMichael, Zhifu Mi, James Milner, Kelton Minor, Jan Minx, Nahid Mohajeri, Natalie C Momen, Maziar Moradi-Lakeh, Karyn Morrissey, Simon Munzert, Kris A Murray, Nick Obradovich, Megan B O'Hare, Camile Oliveira, Tadj Oreszczyn, Matthias Otto, Fereidoon Owfi, Olivia L Pearman, Frank Pega, Andrew J Perishing, Ana-Catarina Pinho-Gomes, Jamie Pomattam, Mahnaz Rabbaniha, Jamie Rickman, Elizabeth Robinson, Joacim Rocklöv, David Rojas-Rueda, Renee N Salas, Jan C Semenza, Jodi D Sherman, Joy Shumake-Guillemot, Pratik Singh, Henrik Sjödin, Jessica Slater, Mikhail Sofiev, Cecilia Sorensen, Marco Springmann, Zélie Stalhandske, Jennifer D Stowell, Meisam Tabatabaei, Jonathon Taylor, Daniel Tong, Cathryn Tonne, Marina Treskova, Joaquin A Trinanes, Andreas Uppstu, Fabian Wagner, Laura Warnecke, Hannah Whitcombe, Peng Xian, Carol Zavaleta-Cortijo, Chi Zhang, Ran Zhang, Shihui Zhang, Ying Zhang, Qiao Zhu, Peng Gong\*, Hugh Montgomery\*, Anthony Costello\*



## Delayed action puts everyone at risk

Despite the health threats brought about by climate change, progress towards net zero greenhouse gas emissions has been limited. To achieve an equitable and healthy future, resources should be urgently redirected towards efforts that benefit people's health and wellbeing.

“

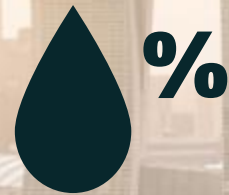
Following decades of delays in climate change action, avoiding the most severe health impacts of climate change now requires aligned, structural, and sustained changes across most human systems, including energy, transportation, agriculture and health care

*2024 report of the Lancet Countdown on health and climate change*

# OUR UNIQUE CHALLENGE



**HIGH  
TEMPERATURES**



**HIGH  
HUMIDITY**



**SUSTAINED  
EXPOSURE**

# HEAT RESILIENCE

## HEALTH PILLARS



Sleep



Diet



Exercise

## LIFE STAGES



Infants



Children



Adults



Elderly

## POPULATION-SPECIFIC



Occupational  
health



Children's  
development



Maternal  
Health

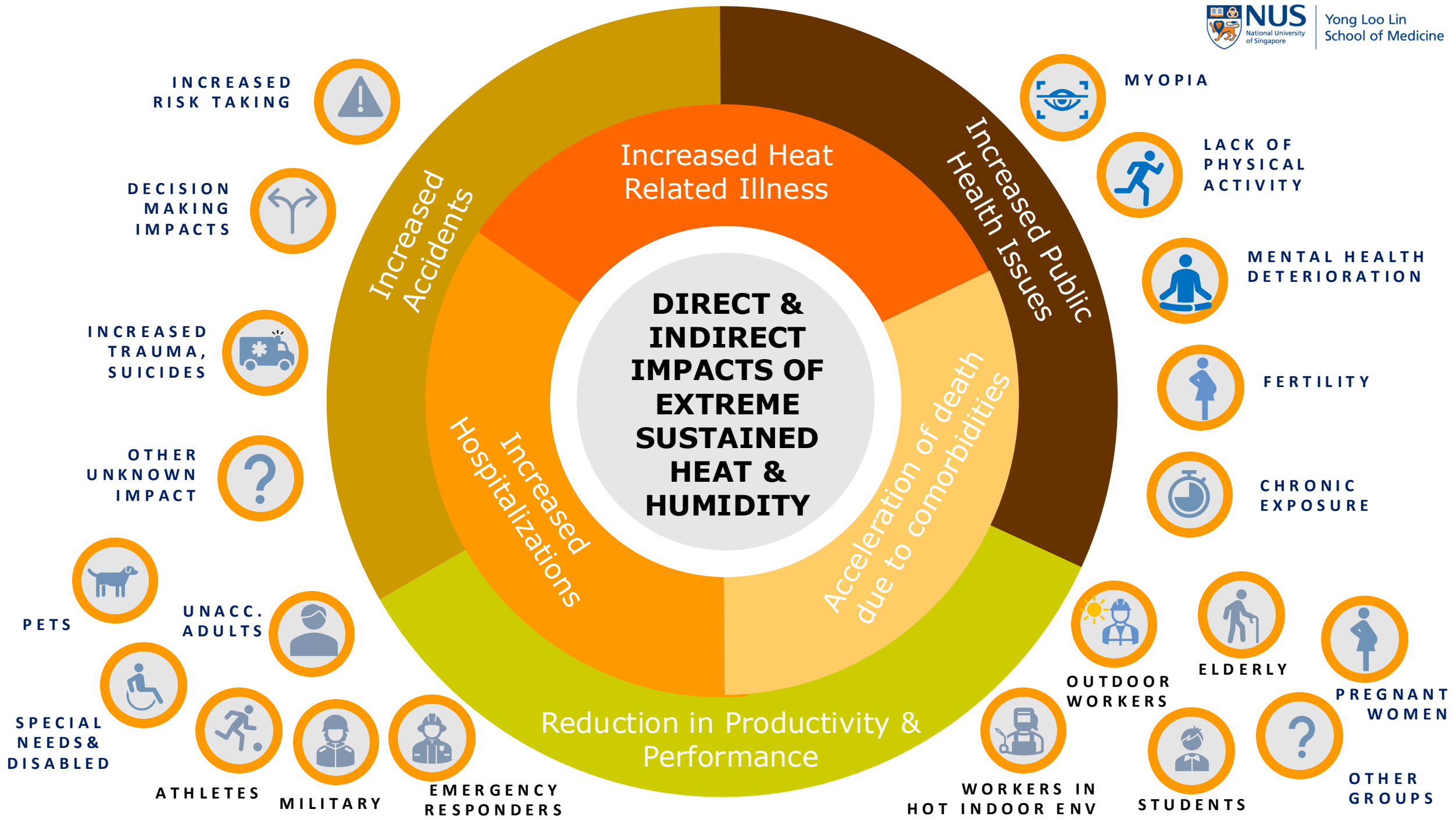


Male  
Fertility



*“Relax. Pot temperatures have been going up and down for centuries.”*

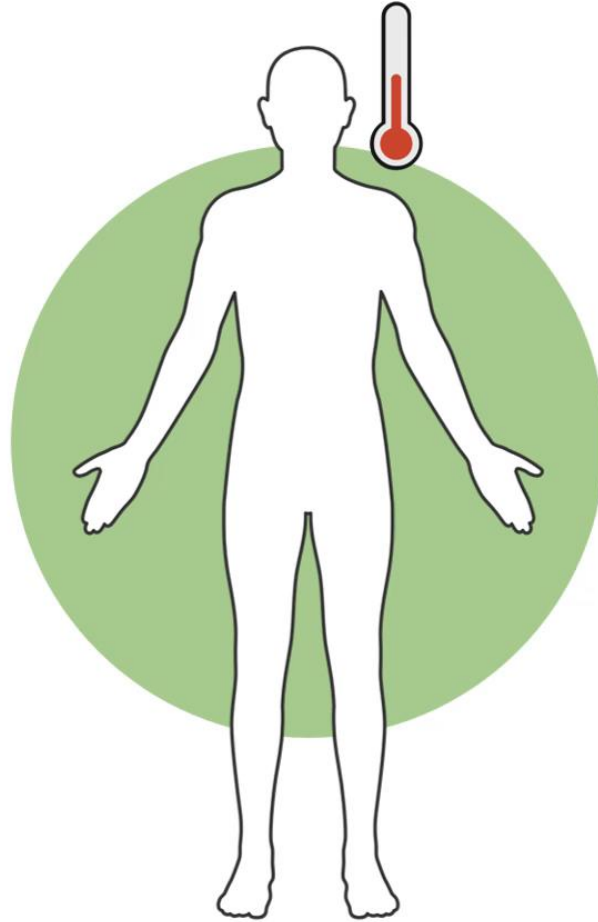
# OUR UNIQUE CHALLENGE



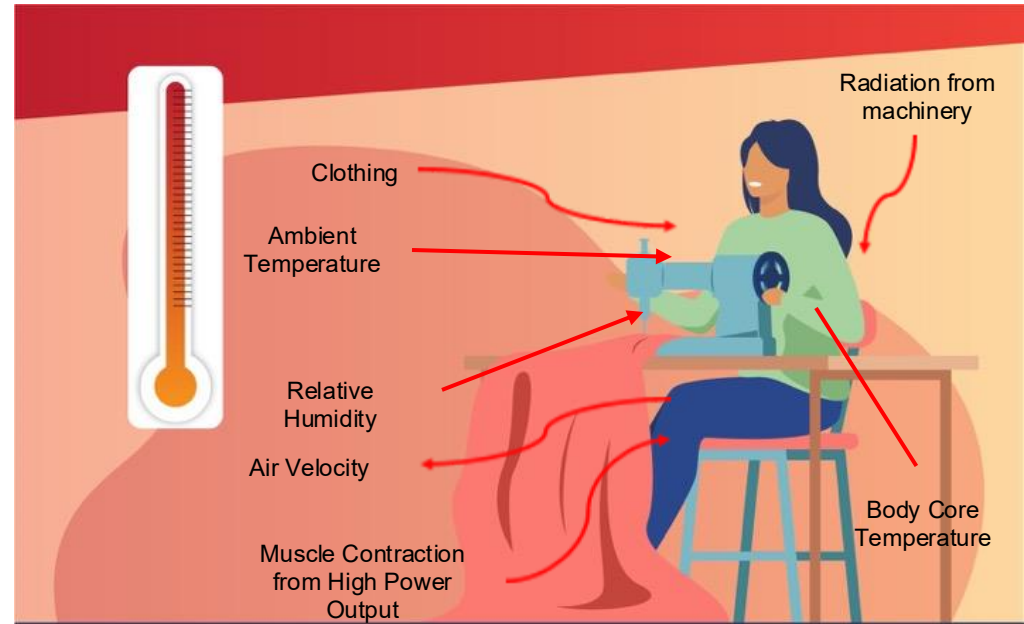
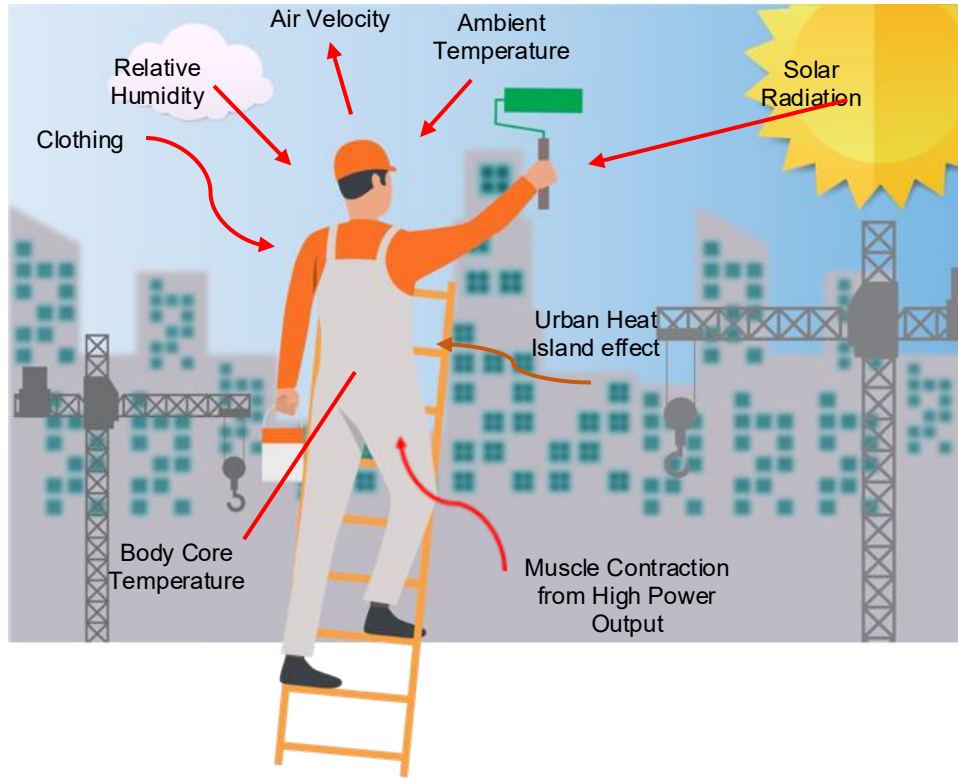


# HOW DOES THE BODY RESPOND TO HEAT?

# THERMOREGULATION



# HEAT STRESS VS. HEAT STRAIN?



**Weather + Attire + Physiology  
(Heat Stress)**



**Heat Strain** ⚠️



THE STRAITS TIMES SINGAPORE PDF Q

## Worker who died after falling off rooftop likely disoriented from heat stress: Coroner



# Thermal Discomfort and Risk Taking



## Healthcare workers face unique risks

For healthcare workers (HCWs) responding to chemical disasters or pandemics, wearing personal protective equipment (PPE) is essential for their safety. However, PPE usage hampers heat dissipation and increases thermal strain experienced by HCWs as they execute their tasks.

**Observed Consequences of Heat Exposure**

- Increased risk-taking behaviour**  
May affect adherence to safety procedures and increase workplace accidents.
- Loss in maximal strength**  
May increase injury risks and compromise the ability of HCWs to perform lifesaving procedures that require good manual dexterity and strength.

## Managing heat strain while wearing PPE

A recent study by Alhadad et al. (2024) found that effective heat management strategies can be as straightforward as consuming an ice slurry before donning PPE and engaging in strenuous tasks:

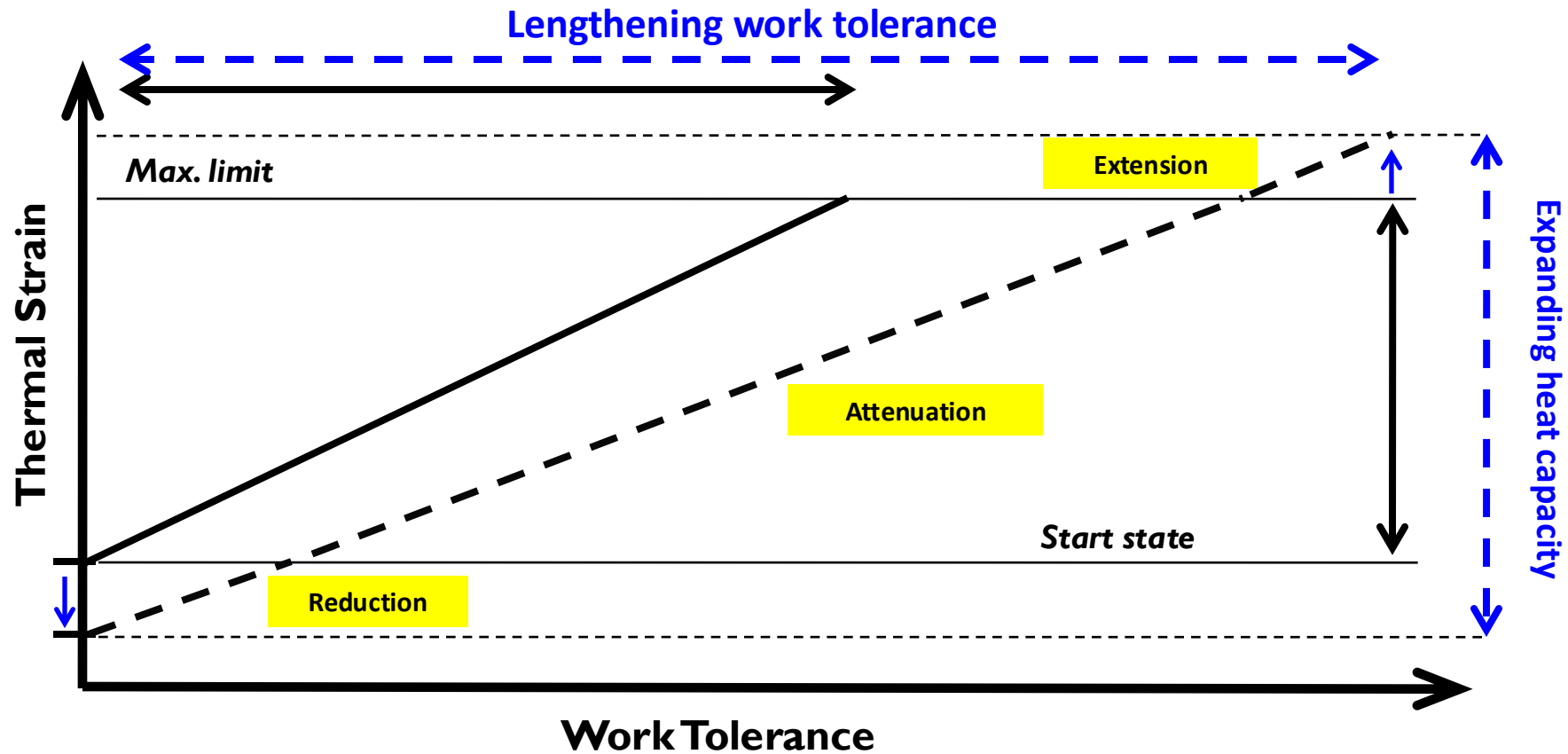
**Key Findings & Implications**

Ambient temperature	VS	Ice slurry
 <b>Loss in maximal strength</b>		 <b>No change in maximal strength</b>
 <b>Increased risk-taking behaviour</b>		 <b>No change in risk-taking behaviour</b>

Ice slurry ingestion effectively prevented the decline in maximal strength and risk-taking behavior, indicating its potential to attenuate these adverse heat risks in thermally challenging situation.

# MANAGING HEAT STRAIN

## PHYSIOLOGICAL SOLUTIONS



# PHYSIOLOGICAL SOLUTIONS



**AEROBIC FITNESS  
CONDITIONING**

Reduction

Attenuation

Extension



**HEAT  
ACCLIMATIZATION**

Reduction

Attenuation



**PRE-ACTIVITY  
COOLING**

Reduction



**WORK REST CYCLES**

Reduction

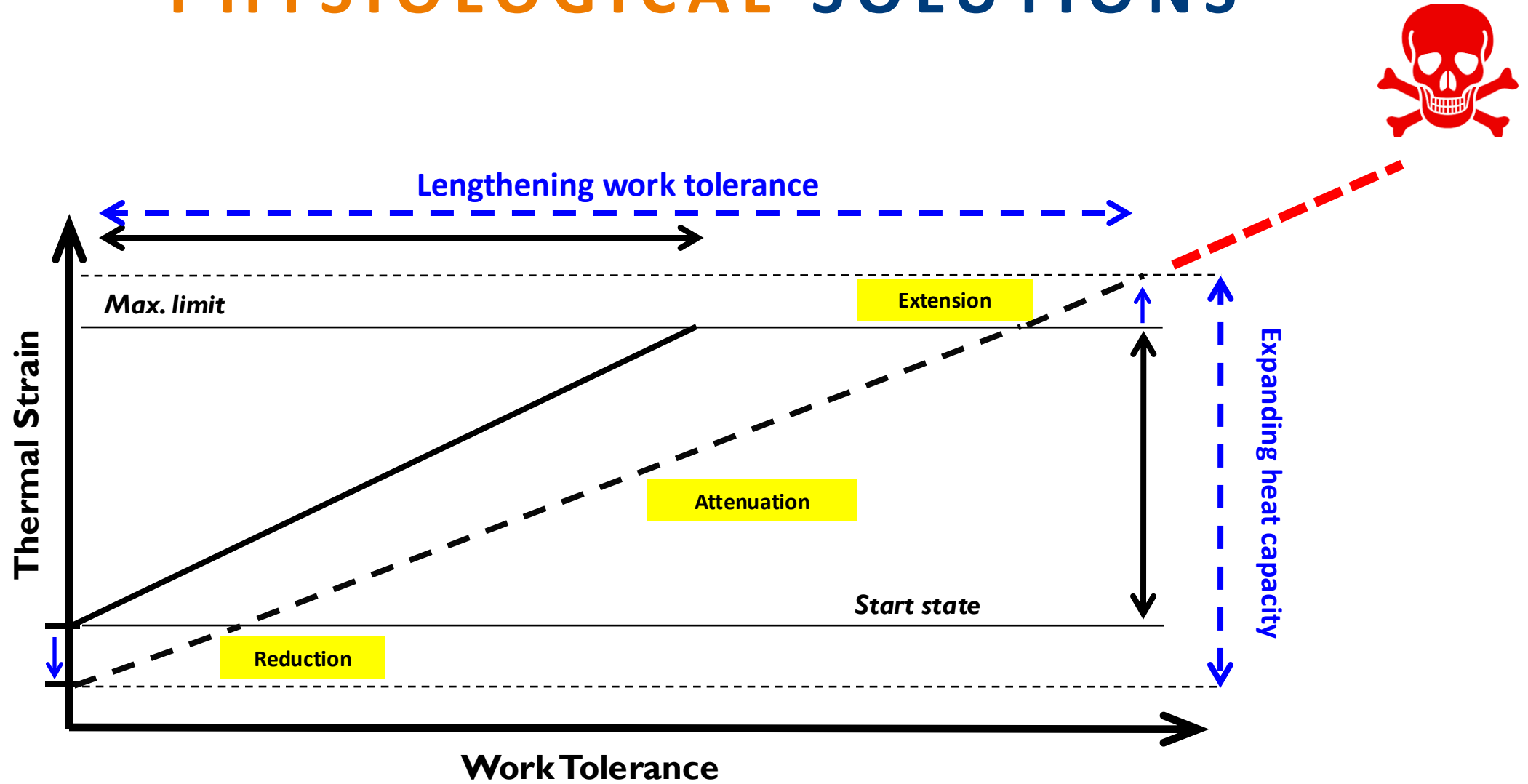
Attenuation



**HYDRATION**

Attenuation

# PHYSIOLOGICAL SOLUTIONS



# PROOF OF CONCEPT: REAL TIME HEAT HEALTH MONITORING



HRPC

## Start of the 21 km race



00:03:15

Race started at 4:31:50 AM on 8/27/2023

On Warning In Danger

BIB	Battery	HR (bpm)	Pace (min/km)	Temp (°C)
No runners match the current filters.				

# GLOBAL HEAT HEALTH INFORMATION NETWORK NETWORK SOUTHEAST ASIA HUB



Heat Resilience & Performance Centre  
Yong Loo Lin School of Medicine



GLOBAL HEAT HEALTH  
INFORMATION NETWORK



WORLD  
METEOROLOGICAL  
ORGANIZATION



World Health  
Organization



# GHHIN Southeast Asia Hub

A platform for Southeast Asia to collectively prepare for and protect populations from the health impacts of extreme heat



GLOBAL HEAT HEALTH  
INFORMATION NETWORK  
SOUTHEAST ASIA

## OUR GOALS

### PEOPLE

Connect people and institutions to form multi-disciplinary partnerships to reduce heat risks

### SCIENCE & INFO

Accelerate the generation of evidence, actionable knowledge, standardised guidance, risk metrics, and effective communication

### ACTION

Catalyse regional, national and local policy and action to minimize societal consequences of heat impacts

## REGIONAL FOCUS AREAS



Urban Heat



Heat at Work



Traditional &  
Cultural Practices

## JOIN US

[www.ghhin.org/southeastasia/](http://www.ghhin.org/southeastasia/)



Connect to the Hub & Global Heat Health Digest  
Access Recordings & Materials of our First Forum



Heat Resilience & Performance Centre  
Yong Loo Lin School of Medicine



JOINT OFFICE FOR CLIMATE AND HEALTH



# GLOBAL SCIENCE

## LOCAL SOLUTIONS

It's a health equity issue and it's an opportunity: **Heat is a unifying threat** that crosses sectors and borders, enabling collective action and shared investment.

**Ms Ko Barrett**

WMO Deputy Secretary-General



**Naveen Rao** · 2nd

Senior Vice President of Health

3w · 🌐

+ Follow ...

It was an honor to be joined by esteemed colleagues yesterday at #WHA78 to announce the **World Health Organization World Meteorological Organization** Climate and Health Joint Program.

The health impacts of the climate crisis are intensifying, threatening lives, livelihoods and the systems we rely on. Integrating climate and health is no longer optional – it is essential and must happen as fast as possible to protect lives.

That is why **The Rockefeller Foundation** and **Wellcome Trust** joined forces to provide a \$11.5m investment to support the WMO-WHO joint program and scale up insights for climate-health decision making.

This partnership aims to change that - fast. Together, we will:

- Launch and scale health-meteorological units in 7 countries across Africa, Latin America, and Asia
- Strengthen collaboration between health and climate sectors in 80+ countries
- Expand early warning systems, data tools, and science-based decision-making to protect the most vulnerable

To make climate services for health a success, we need to work together to build political will, catalyze partnerships and create awareness about the benefits.

With committed and passionate partners, I am confident that this program can have a transformative impact.

**Celeste Saulo Alan Dangour Thomas Asare Ko Barrett Charlotte**

**Watts Ibrahima Sy, Sayedur Rahman, Pedro Gullón Tosio Agnes Soares da**

**Silva, Reema Nanavaty, Petra Khoury, Abderrezak Bouchama Dr. Jane**

**Thornton OLY Ousman Ndiaye, Jason Kai Wei LEE Marc Gordon Alan Dangour**

Learn more about the joint program here: <https://lnkd.in/gagWc2iv>

**Remember  
them**





Human Potential Translational  
Research Programme  
Yong Loo Lin School of Medicine



Heat Resilience & Performance Centre  
Yong Loo Lin School of Medicine