Working in a Warming World

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Optimum Safety for Optimum Performance

Summary

1. Optimal safety **does not** compromise but enhances productivity

2. Heat stress can **induce more than** just heat injuries and performance degradation

3. Harnessing **wearables, AI and IoT** to optimise efficacy and efficiency

The Problem

Home | Video | World | Asia | UK | Business | Tech | Science | Stories | Entertainm

Science & Environment

Climate change: Summers could become 'too hot for humans'

By David Shukman
Science editor

16 July 2020 Share

UK heatwaves

Climate countdown Climate change

Rising temperatures will cause more deaths than all infectious diseases - study

Poorer, hotter parts of the world will struggle to adapt to unbearable conditions, research finds

Heat wave in India leaves millions struggling to cope

By Sharanya Hrishikesh
BBC News, Delhi

29 April

Climate change

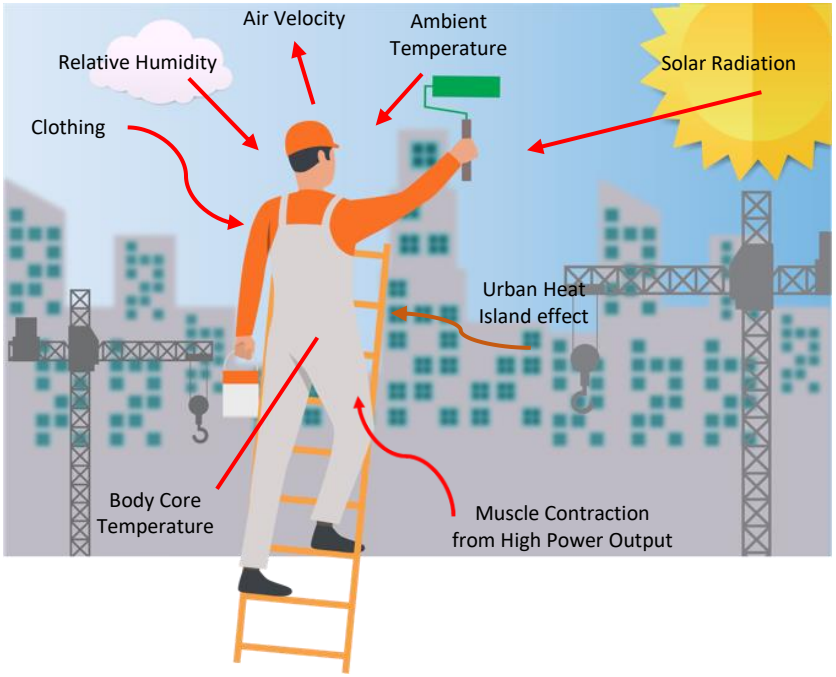
Summer began early this year in India

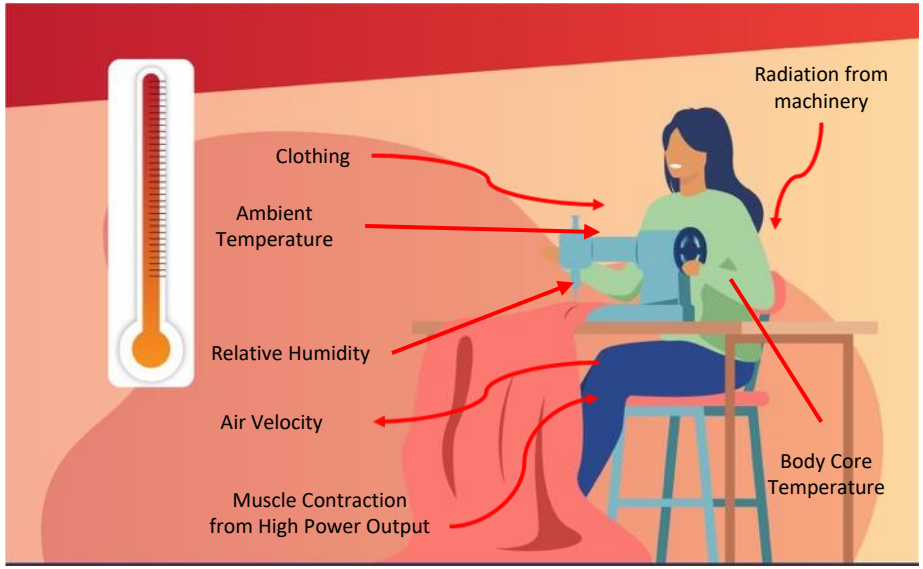
cna Singapore

Temperature soars to 37°C in Singapore, equals record for daily high set in 1983

13 May 2023 06:30PM

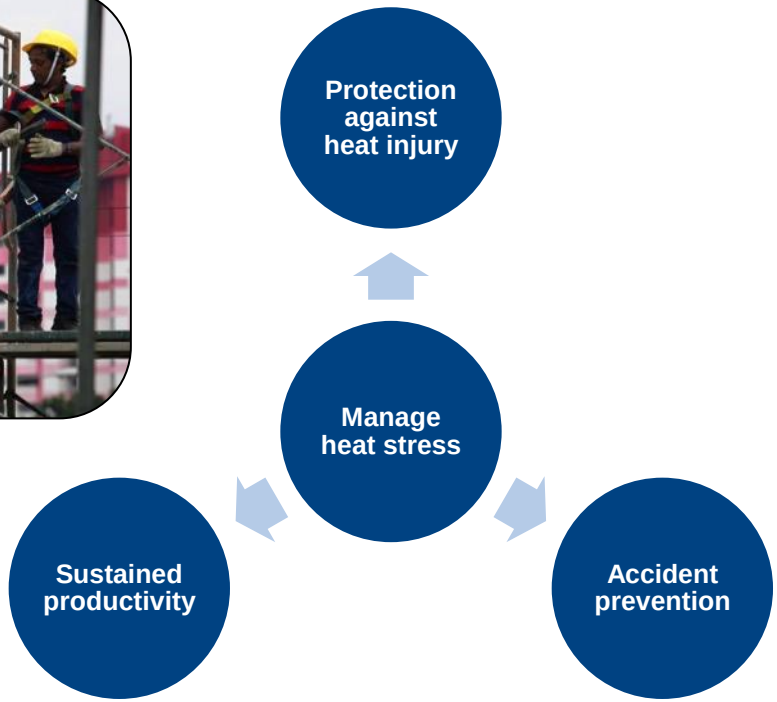
Heat Stress and Heat Strain





Climate + Clothing + Exercise (Heat Stress) → **Heat Strain**

The Challenge



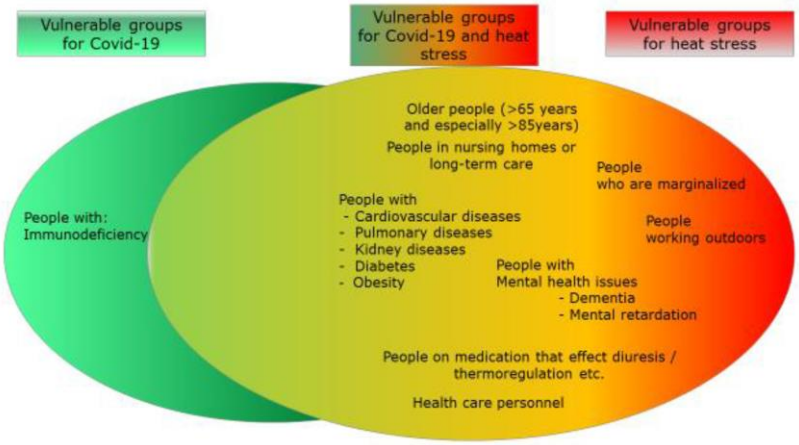
Heat increases Chronic Kidney Disease (non-traditional)

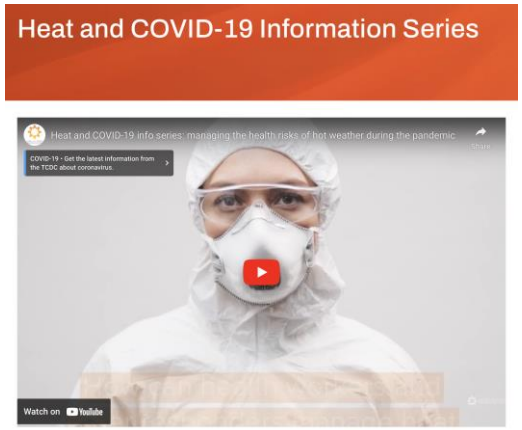
Article

Pathophysiological Mechanisms by which Heat Stress Potentially Induces Kidney Inflammation and Chronic Kidney Disease in Sugarcane Workers

Hansson et al. (2020), Nutrients

Recommendations to protect humans against Heat AND SARS-CoV-2 need to be adapted





Compatibility of measures for the protection against the two different hazards

Protection against heat-related illnesses or mortality		Protection against Covid-19
Regular care – professional caretaker	X	Physical distancing (1–2 m)
Regular support – relatives, neighbourhood help/volunteers	X	Self-isolation/social distancing
Cool, breathable clothing	X	Face mask in all public buildings, shops, plastic facial screens, etc.
Visiting cooling centers, cool spaces outdoors to avoid staying in overheated homes	?	Staying at home as much as possible
Using night cooling; windows closed during heat	?	Airing rooms regularly
Avoid physical activity during hot hours	?	Regular physical exercise to strengthen the immune system

Bose-O-Reilly et al. (2021), ER

Heat increases Risk Taking

Appl Ergon. 2017 Jul;62:150-157. doi: 10.1016/j.apergo.2017.02.018. Epub 2017 Apr 6.

Effects of heat stress on risk perceptions and risk taking.

Chang CH[1], Bernard TE[2], Logan J[2].

Author information

Abstract

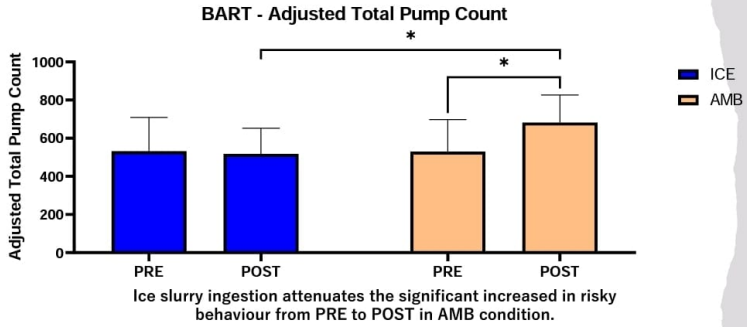
Exposure to extreme heat at work is a serious occupational hazard, as exposure can result in heat-related illnesses, and it has been linked to increased risk of accidents and injuries. The current study aimed to examine whether heat exposure is related to changes in individuals' psychological process of risk evaluation, and whether acclimatization can mitigate the effect of heat exposure. A study with quasi-experiment research design was used to compare participants' risk perceptions and risk-taking behaviors at baseline, initial exposure to heat, and exposure after acclimatization across male participants who were exposed to heat (N = 6), and males (N = 5) and females (N = 6) who were in the control group who were exposed to ambient temperature. Results show that participants perceived the same risky behaviors to be less risky ($p = 0.003$) and demonstrated increased risk-taking behaviors ($p = 0.001$) after initial heat exposure. While their risk perceptions returned to baseline level after acclimatization, their risk-taking behaviors remained heightened ($p = 0.031$). Participants who were not exposed to heat showed no significant fluctuation in their risk perceptions and risk-taking. Our findings support that risk-related processes may explain the effects of heat exposure on increased accidents and injuries beyond its direct impact on heat-related illnesses.

32 lives lost: Workplace fatalities in S'pore in 2022

"Participants who were not exposed to heat showed no significant fluctuation in their risk perceptions and risk-taking. Our findings support that risk-related processes may explain the effects of heat exposure on increased accidents and injuries beyond its direct impact on heat-related illnesses."

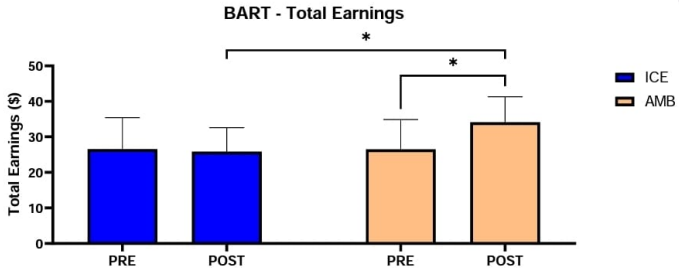
Heat increases Risk Taking

Cognitive Task BART (1) – Adjusted Total Pump Count



Ice slurry ingestion attenuates the significant increased in risky behaviour from PRE to POST in AMB condition.

Cognitive Task BART (2) –Total Earnings



Greater risk-taking propensity in AMB was rewarded with higher total earnings, but risk is not always rewarded.

PROJECT HEATSAFE

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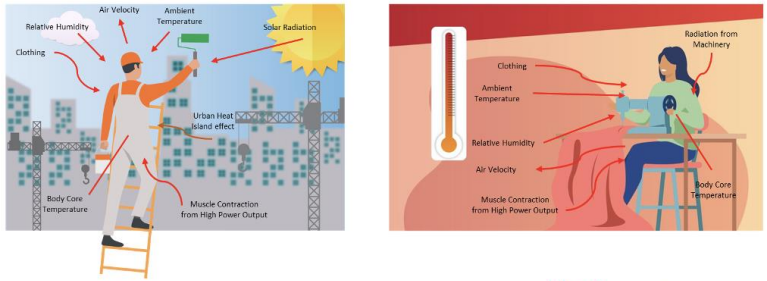
A multidisciplinary approach to augment occupational health and work productivity in a warming world

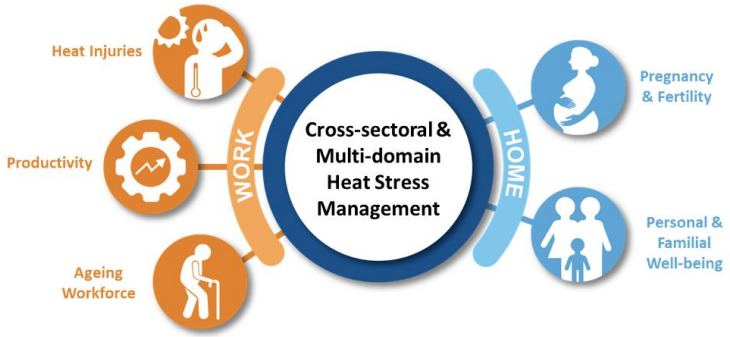
Follow us on Twitter: @ProjectHeatSafe

Heat Strain in Occupational Populations



Heat Stress + Clothing + Exercise ⟶ **Heat Strain** ⚠

Project HeatSafe's Multidisciplinary Approach



Methodology

1. Profile in-situ environmental conditions at worksites

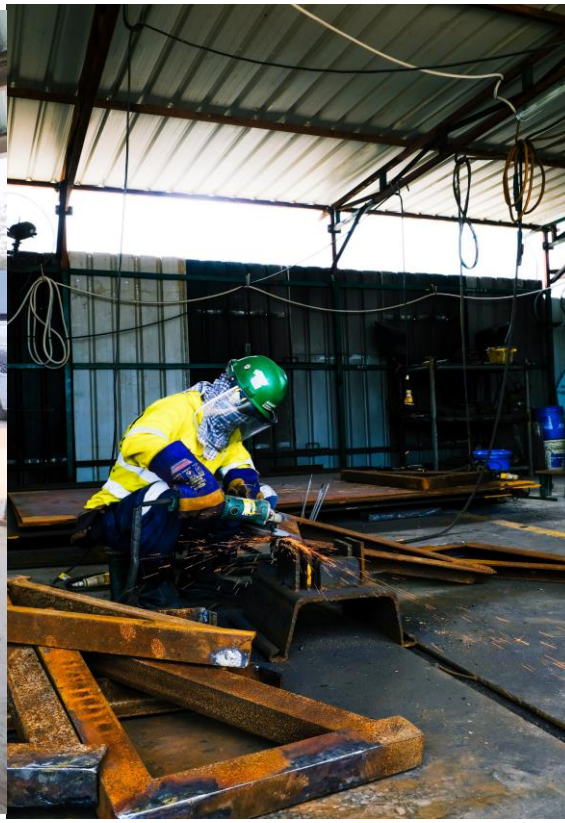
2. Administer surveys

3. Physiology and Ethnography field case studies

Expected Outcomes

- ✓ Economic analysis of work productivity loss due to the heat
- ✓ Impact of heat strain on workers' physiology and performance
- ✓ Social and knock-on impacts of heat on workers and their families
- ✓ Potential interventions to adopt in occupational settings

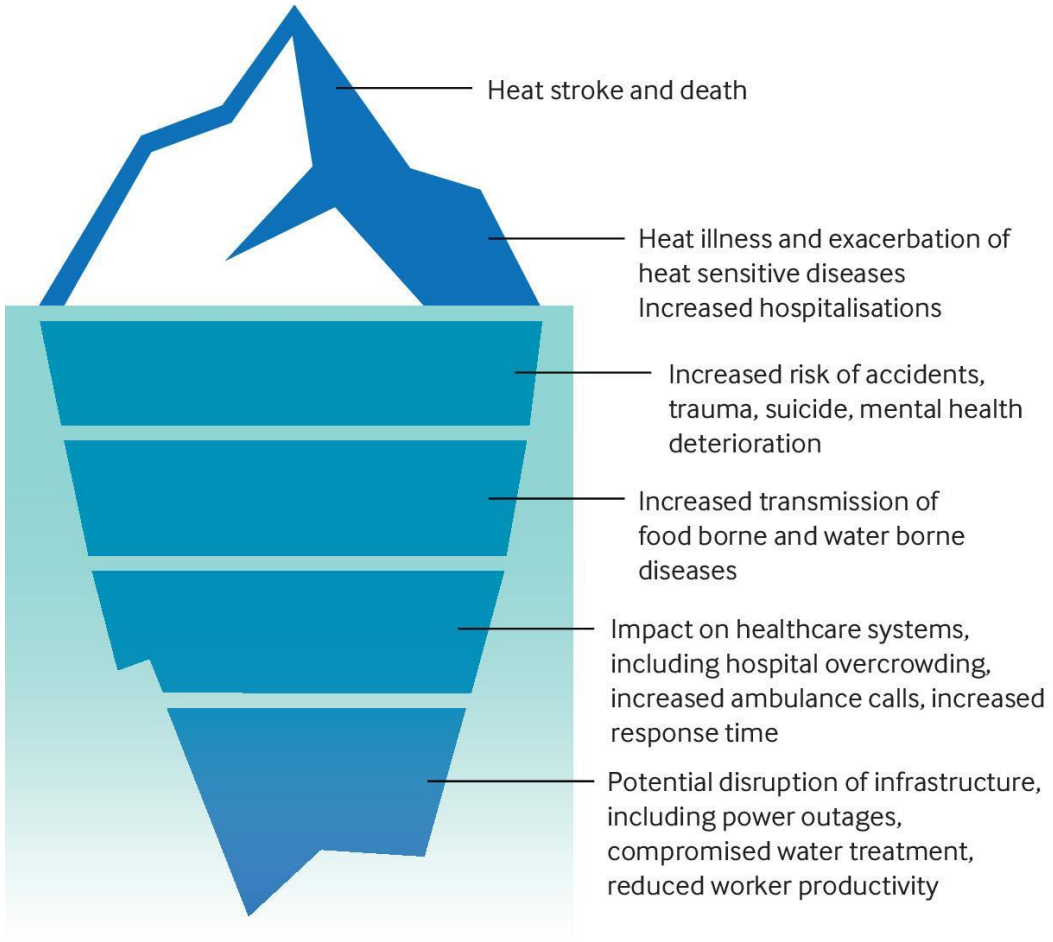
Evaluating Interventions



The Challenge

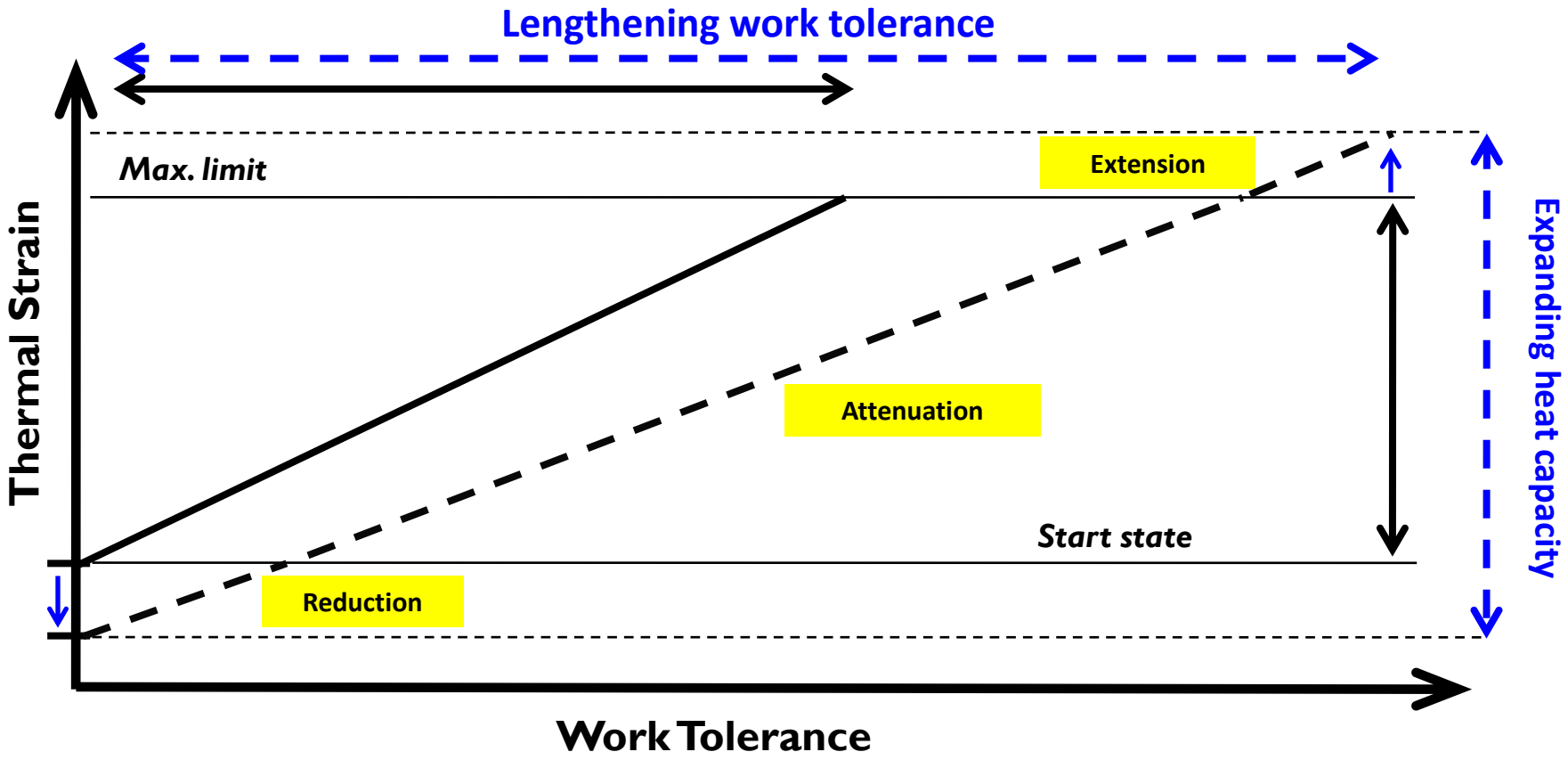
The Challenge

Excessive heat stress can result in many less visible impacts



C Sorensen et al. BMJ 2022;378:bmj-2022-070762

Solutions (Physiological)



Alhadad et al. (2019); Front. Physiol.

Solutions (Physiological)

AEROBIC FITNESS CONDITIONING

Reduction

Attenuation

Extension

HEAT ACCLIMATIZATION

Reduction

Attenuation

PRE-ACTIVITY COOLING

Reduction

WORK REST CYCLES

Reduction

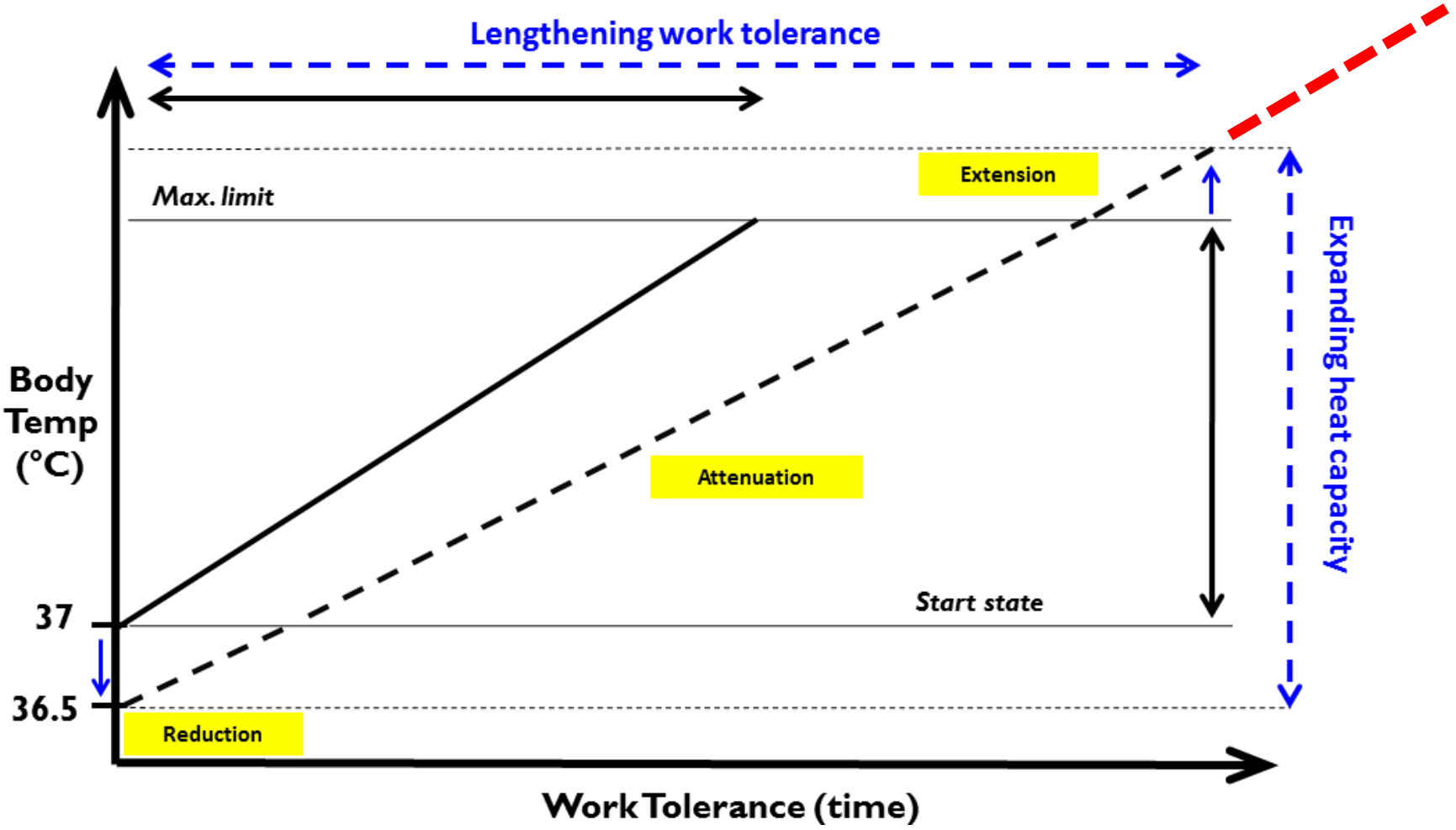
Attenuation

HYDRATION

Attenuation

Alhadad et al. (2019); Front. Physiol.

When one goes beyond his/her limit…



Heat Health Index (Climatic AND Physiology)

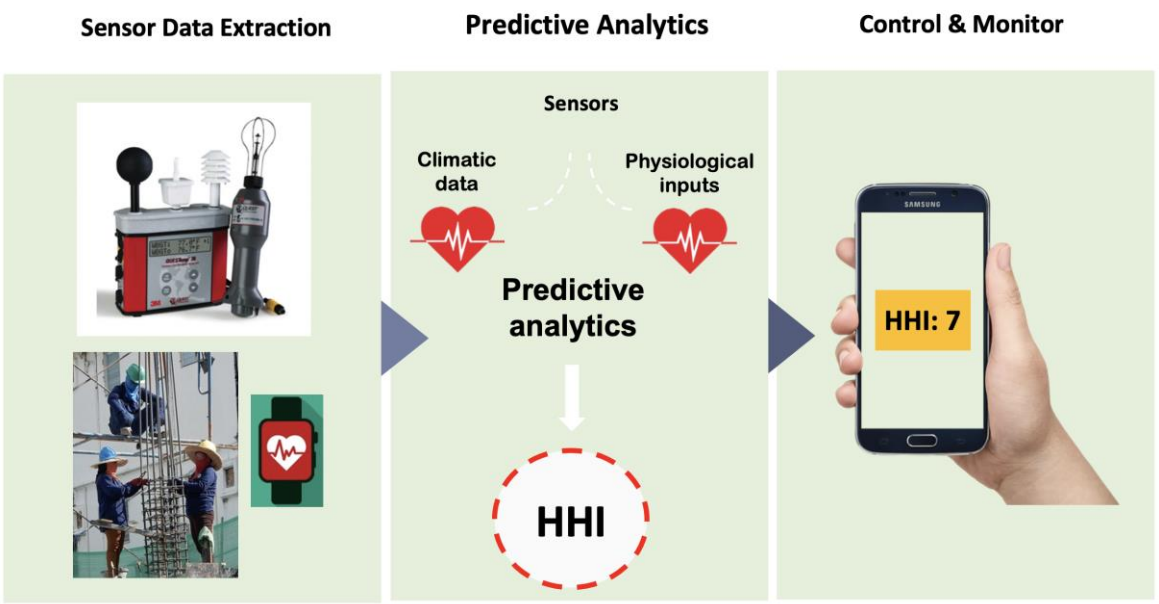
Environ. Res. Lett. **16** (2021) 033005 https://doi.org/10.1088/1748-9326/abd350

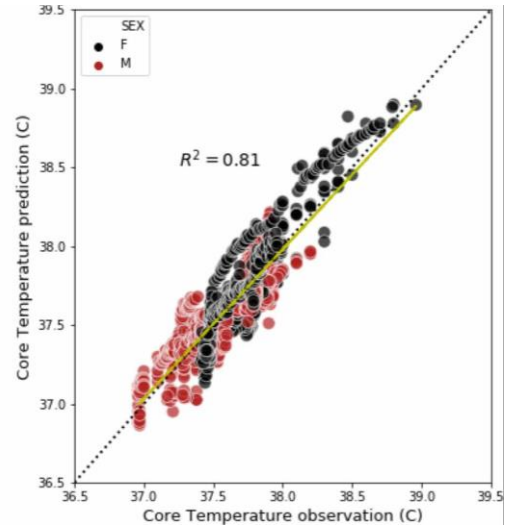
ENVIRONMENTAL RESEARCH
LETTERS

TOPICAL REVIEW

Personal assessment of urban heat exposure: a systematic review

Negin Nazarian[1,2,*] and Jason KW Lee[3,4,5,6,7]





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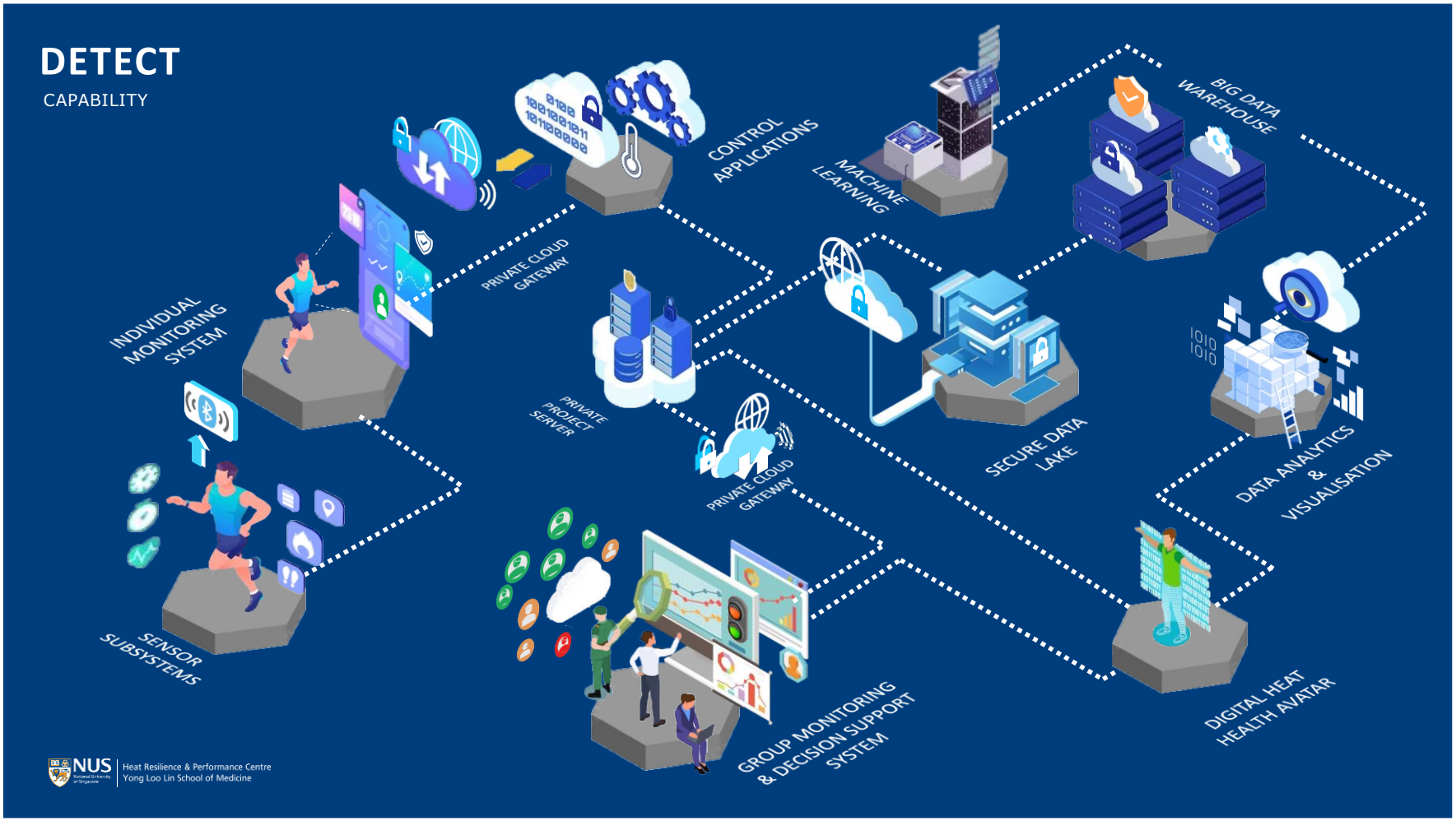

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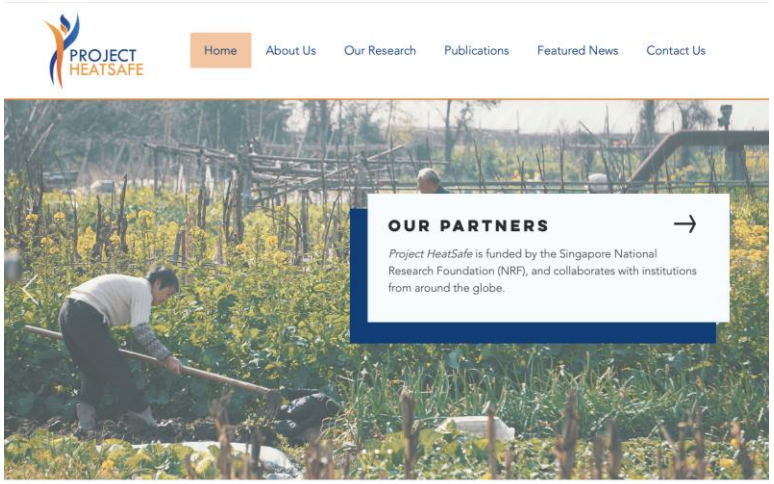
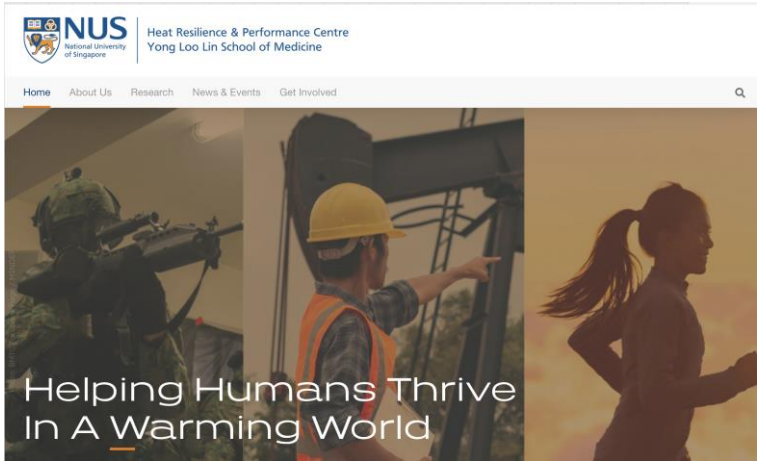
Key Enablers

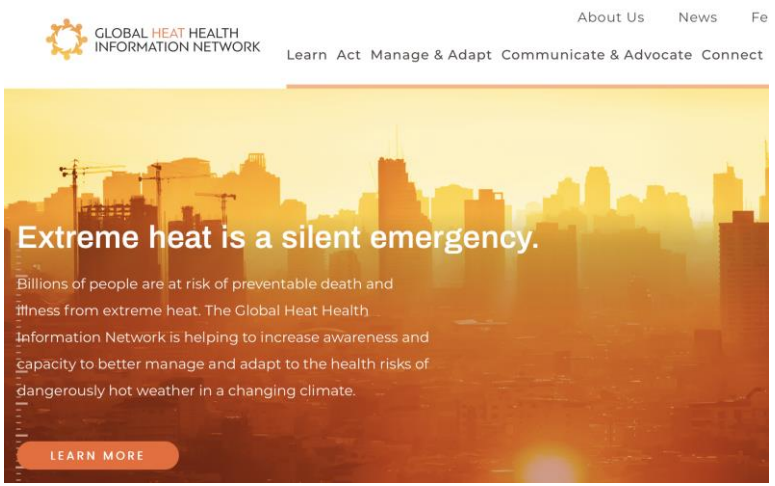


https://www.heatsafe.org



https://medicine.nus.edu.sg/hrpc/

https://www.icohsctf.org



https://ghhin.org

Summary

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Thank you!

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