Workers in a Warming World:

Beyond Heat Injuries and Productivity Losses

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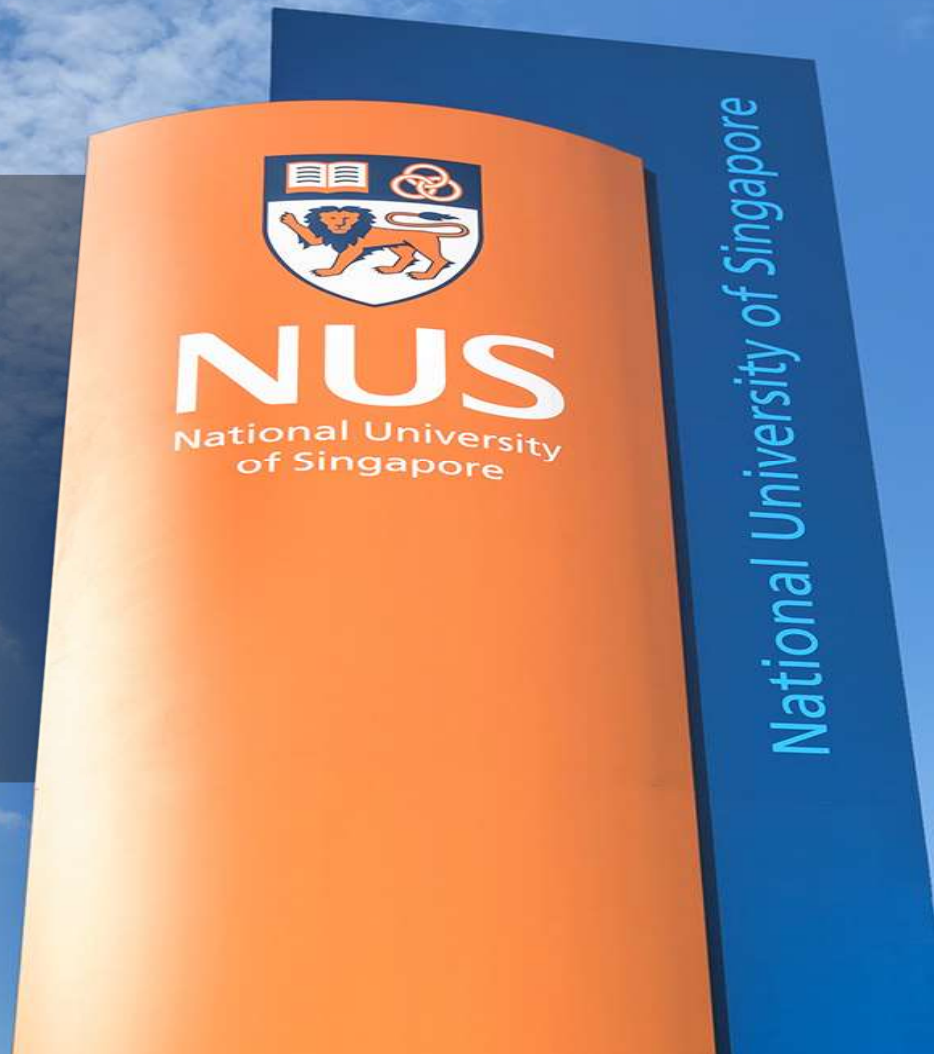
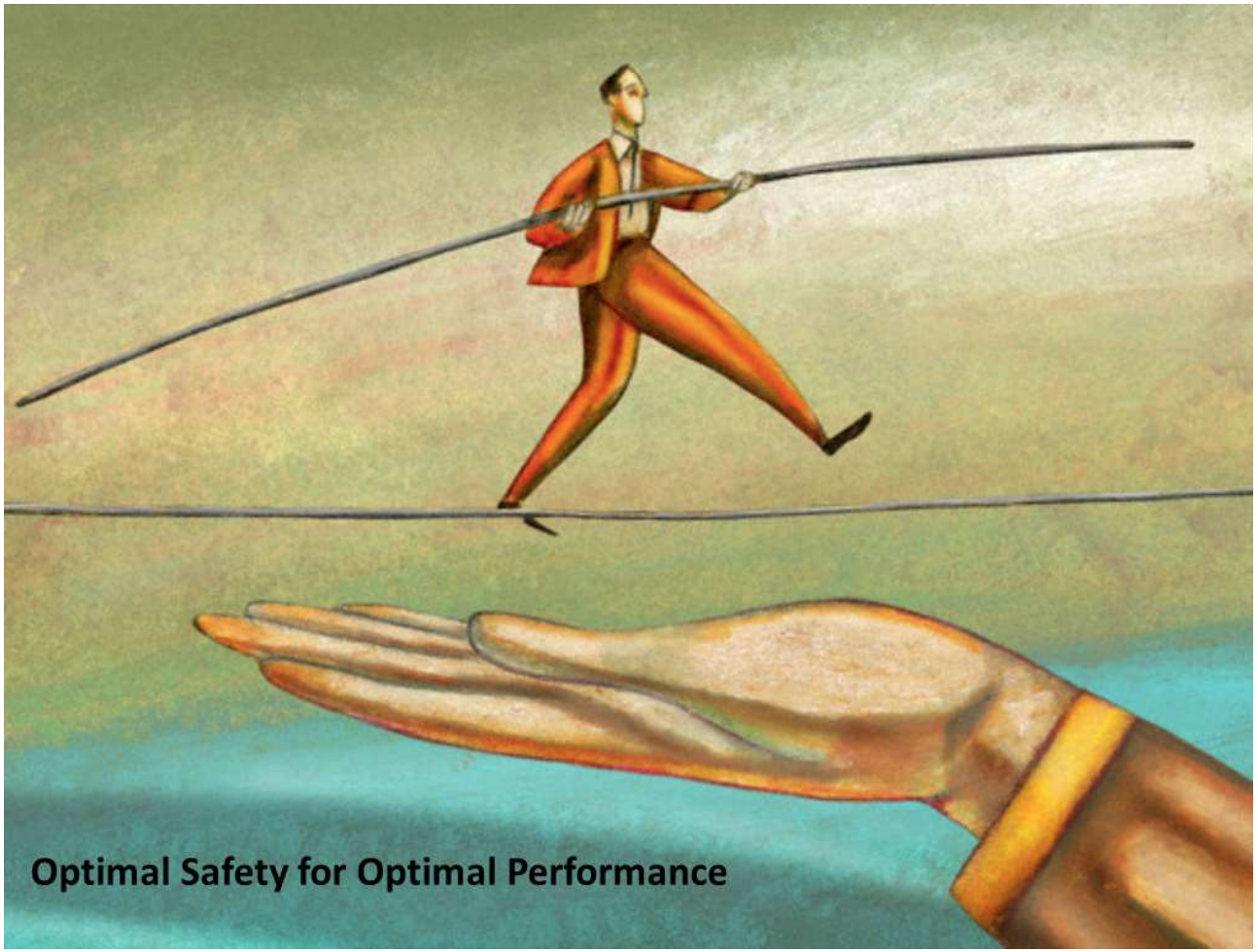




Singapore

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

‘Endless record heat’ in Asia as highest April temperatures recorded

Record figures for month recorded in Thailand, Myanmar, Laos, Vietnam, China and South Asia

Workers move blocks of ice into a storage unit at a market during heatwave conditions in Bangkok. Photograph: Lillian Suwanrumpha/AFP/Getty Images

Hot weather causes rise in heat injury cases, worsens skin conditions

Singapore

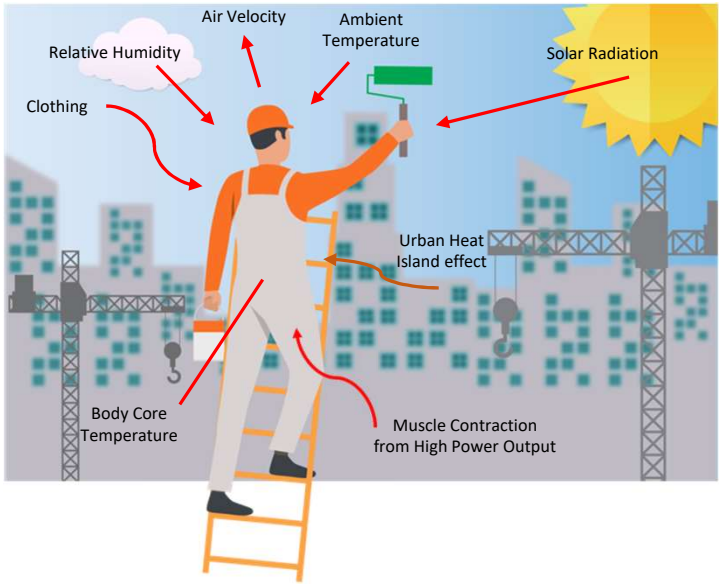
Schools relax rules on student uniforms as hot, humid weather persists

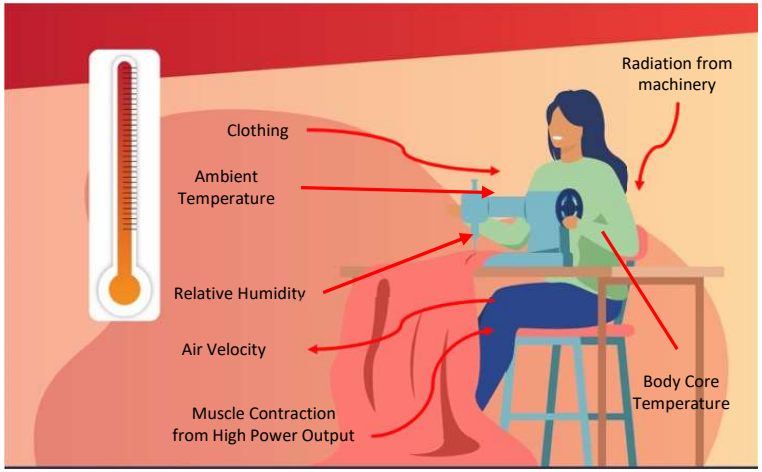
Athletes training in extreme heat: ‘It gets to us, no matter how fit we are’

Singapore

Businesses spending more to cope with Singapore’s sweltering heat

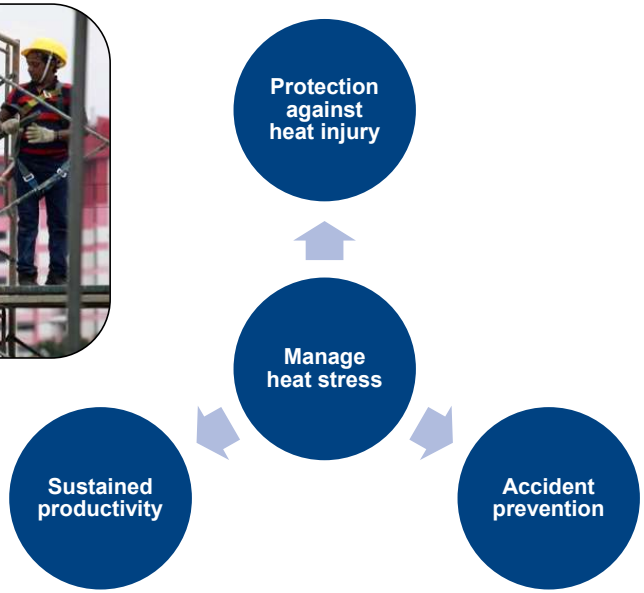
Heat Stress and Heat Strain





Environment + Clothing + Work (Heat Stress) → **Heat Strain** ⚠

The Problem



Heat stress 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

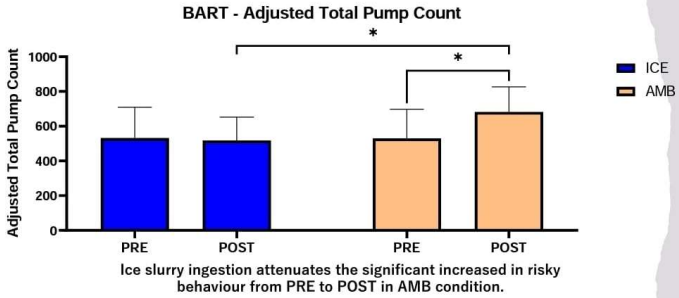
Exposure to extreme heat at work is a serious occupational hazard, as exposure can result in heat-related illnesses, and it has been linked to increased risk of accidents and injuries. The current study aimed to examine whether heat exposure is related to changes in individuals' psychological process 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."

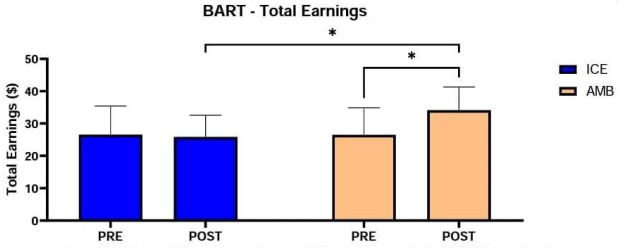
Heat stress increases risk taking

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.

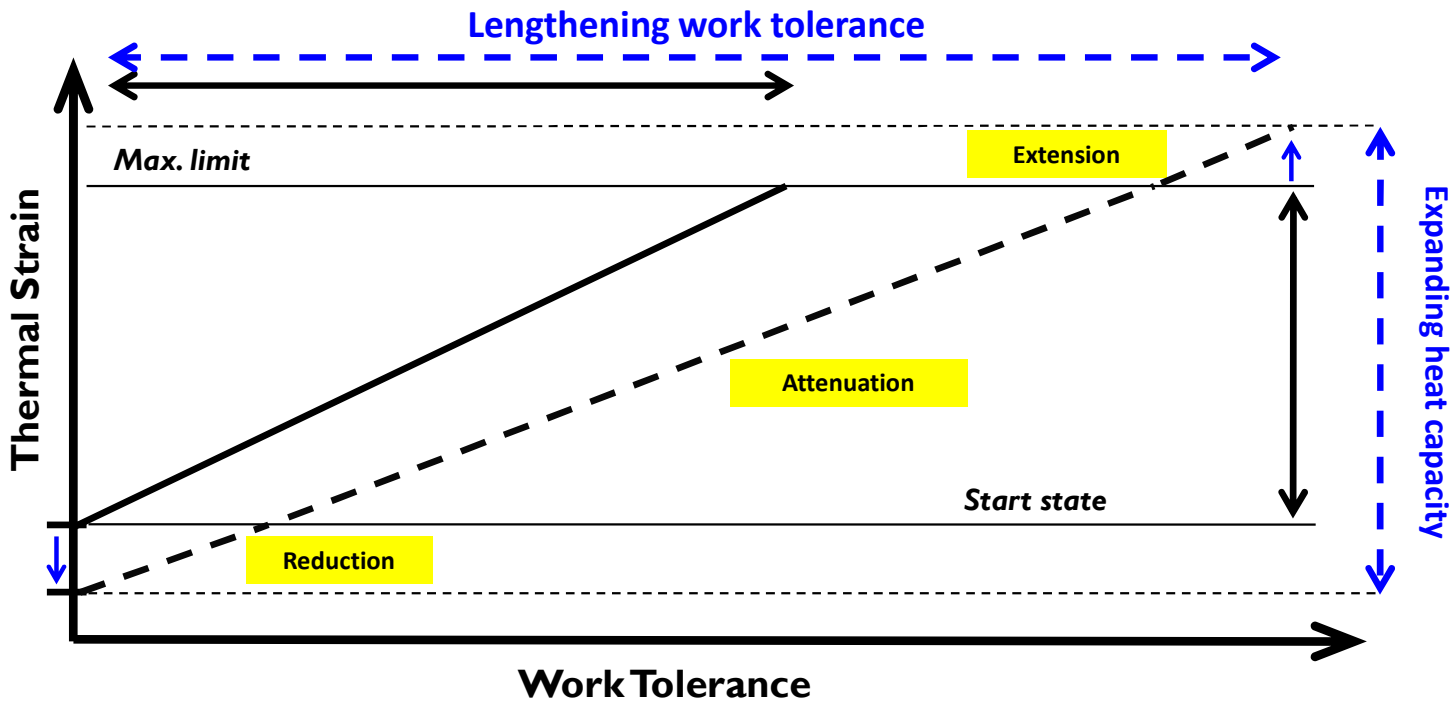
Cognitive Task BART (2) –Total Earnings



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

Singapore General Hospital: Dr. Ponampalam, Dr Rahalkar Kshitij, Aziz Bin Abdul Karim, Zamshek Bin Salamoon, Yogarajah S/O Marimuthu

Solutions (Physiological)



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

STRATEGIES

Behavioural

Aerobic fitness

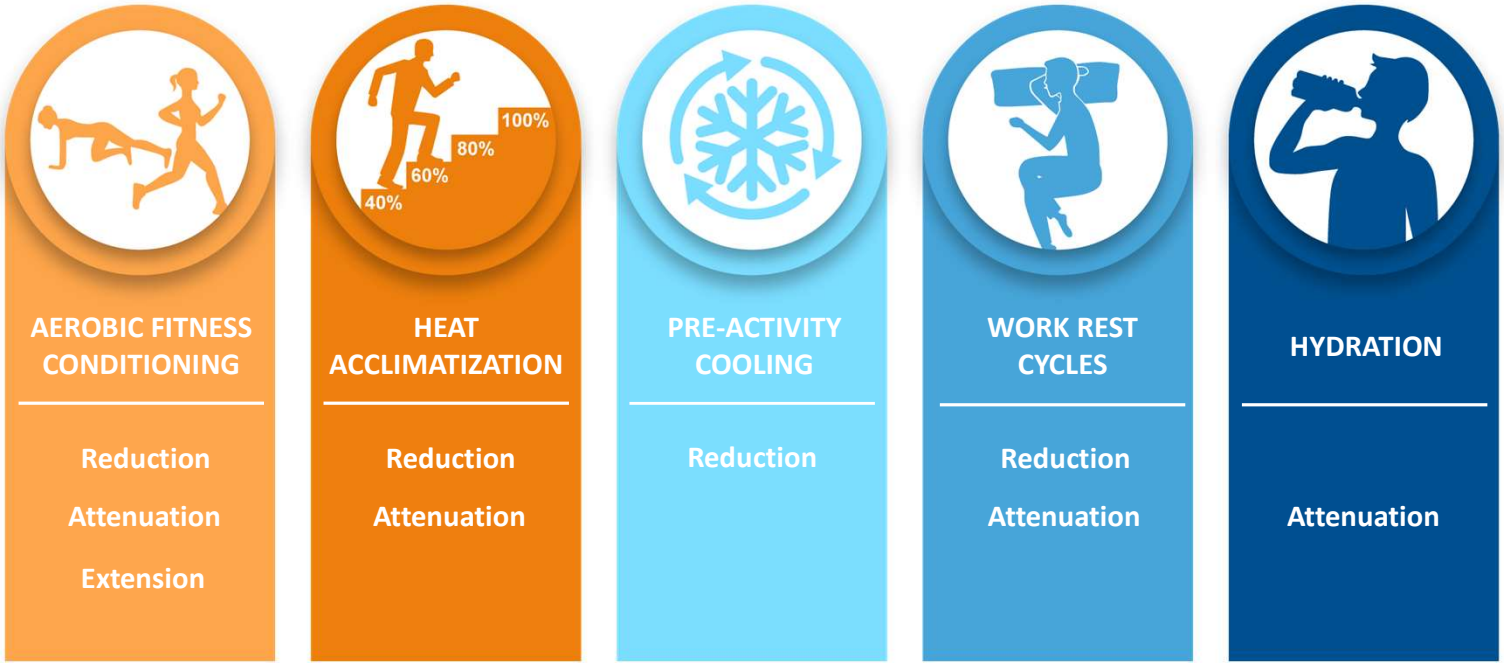
Heat acclimatisation

Pre event cooling

Fluid intake

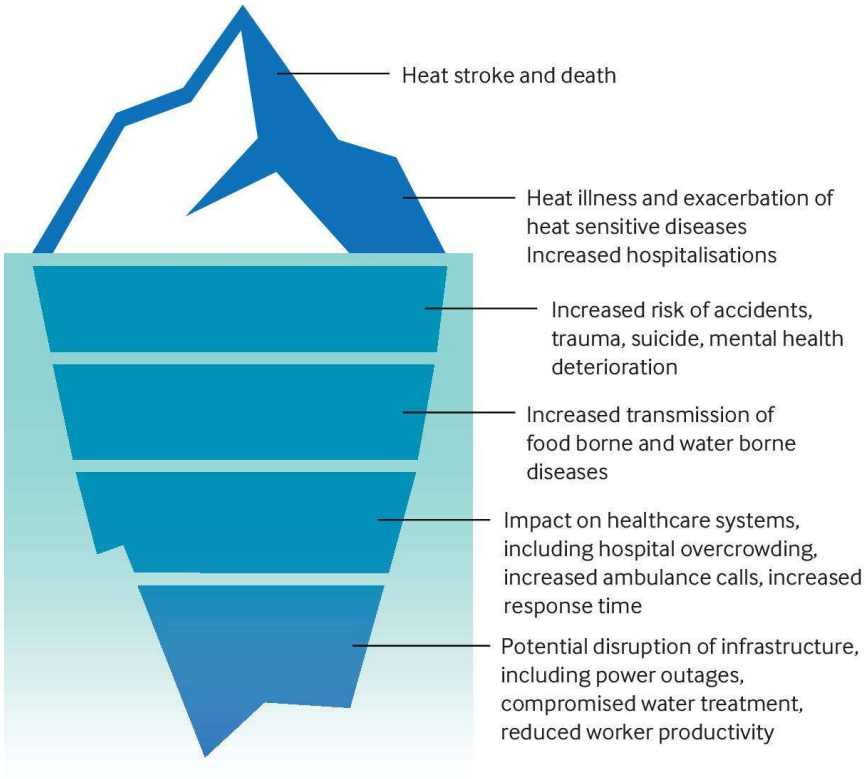
Alhadad et al. (2019); Front. Physiol.

Solutions (Physiological)



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

Excessive heat stress can result in many less visible impacts



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

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

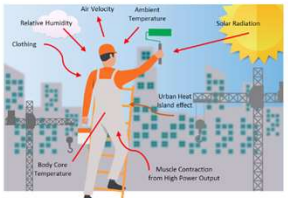
PROJECT HEATSAFE

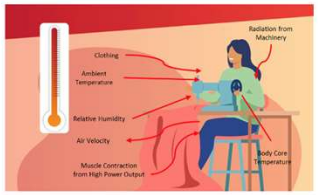
NUS National University of Singapore | Human Potential Translational Research Programme, Yong Loo Lin School of Medicine

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

Follow us on Twitter: @ProjectHeatSafe

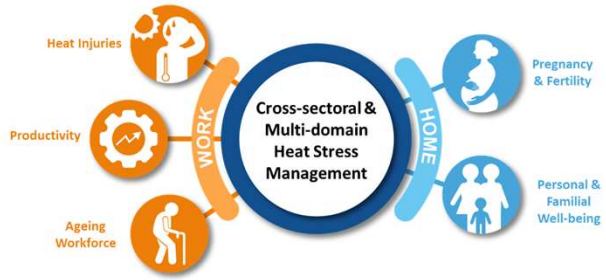
Heat Strain in Occupational Populations





Heat Stress + Clothing + Exercise ⟶ Heat Strain ⚠

Project HeatSafe's Multidisciplinary Approach



Methodology

1. Profile in-situ environmental conditions at worksites

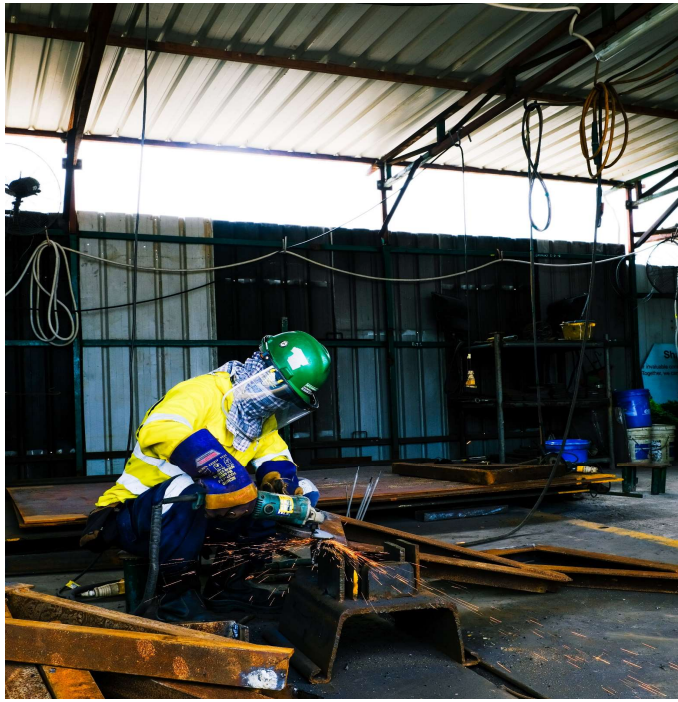
2. Administer surveys

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

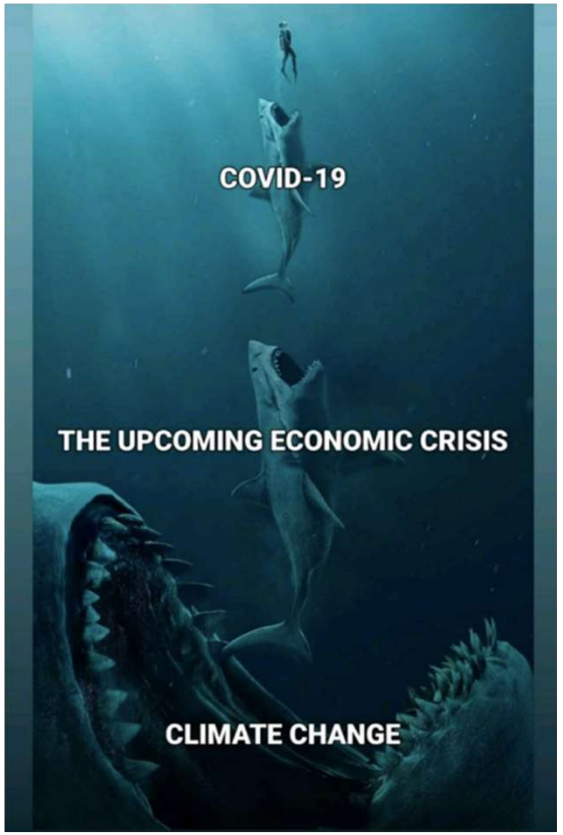
Evaluating Interventions



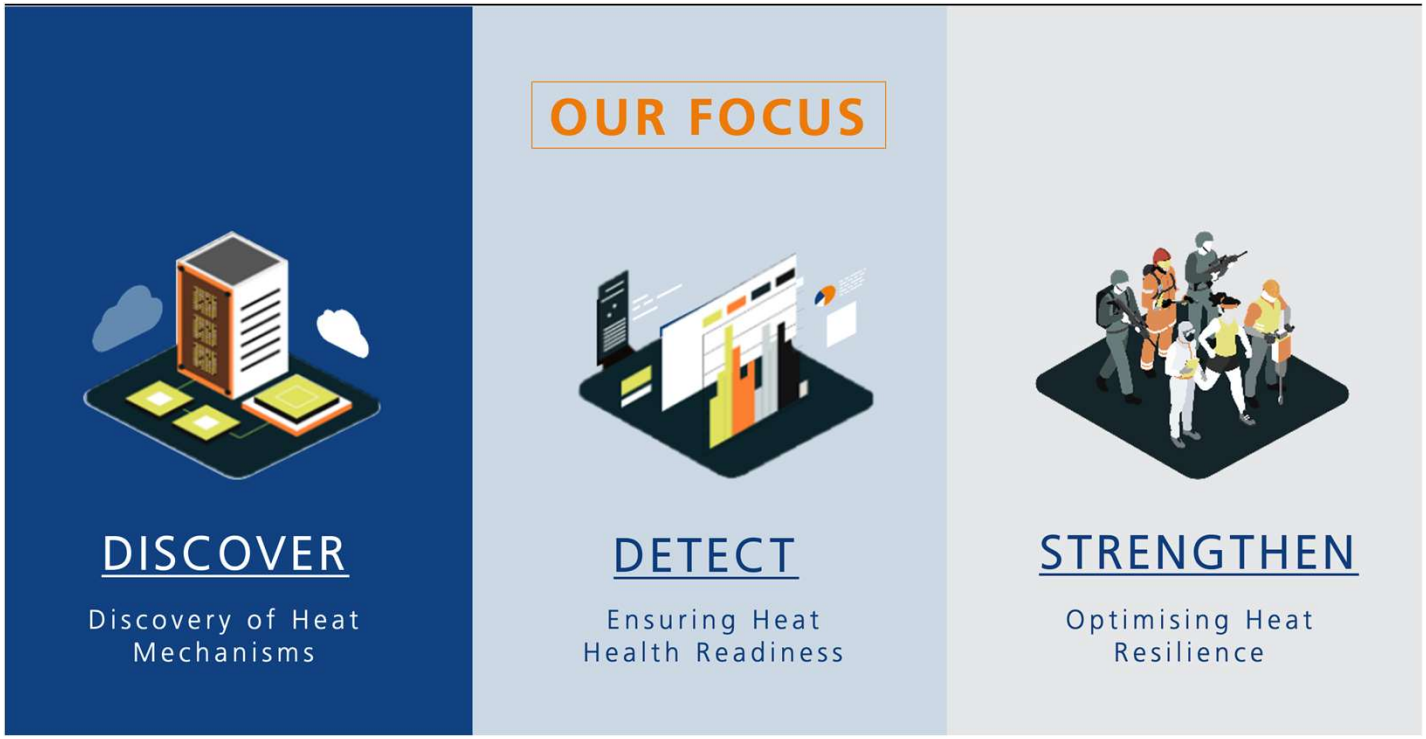
WARNING!

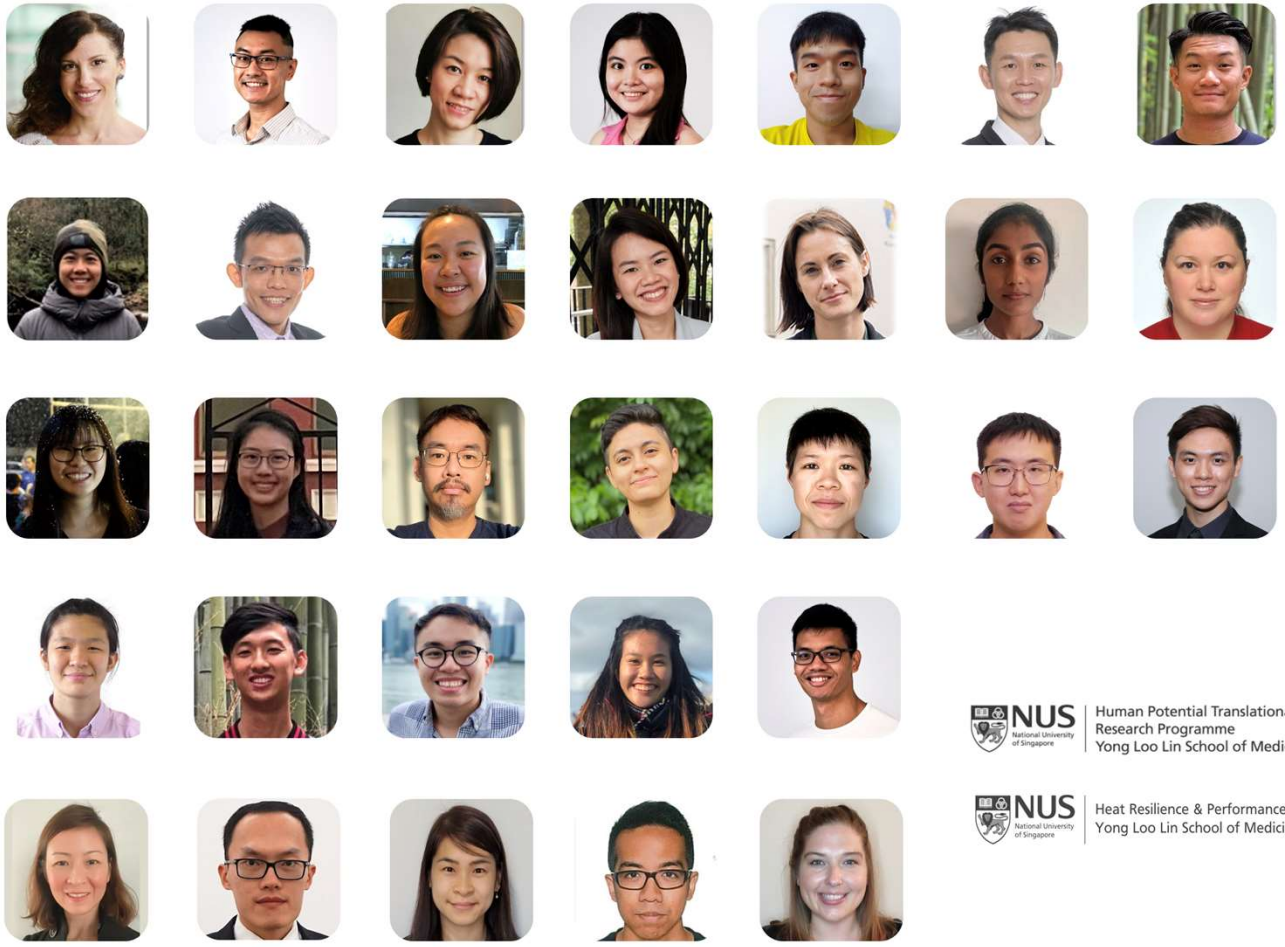
El Nino likely to return this year, fuelling global temperatures, World Meteorological Organization says

Reuters



Heat Resilience and Performance Centre (HRPC)





NUS National University of Singapore | Human Potential Translational Research Programme
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NUS National University of Singapore | Heat Resilience & Performance Centre
Yong Loo Lin School of Medicine

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