

EVIDENCE-BASED GUIDELINES TO BOOST HEALTH AND WORK PRODUCTIVITY IN A WARMING WORLD

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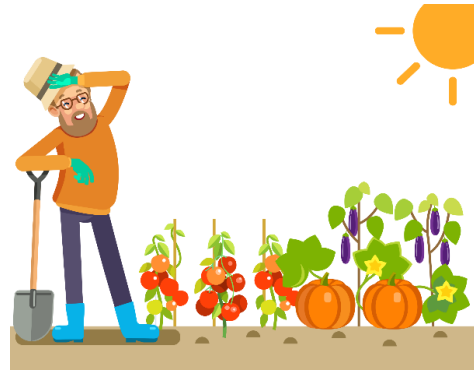
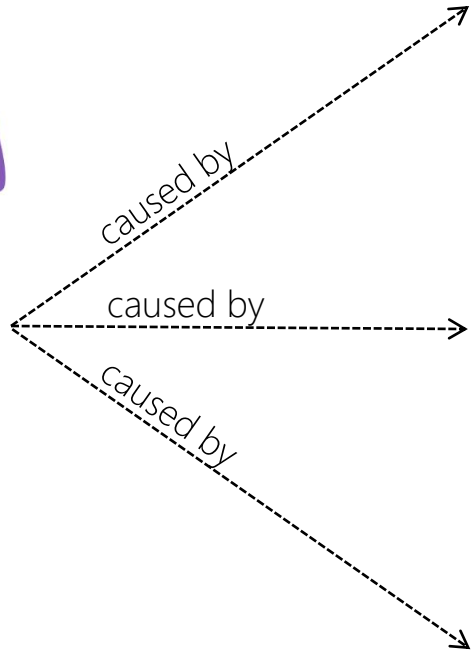


HEAT
SHIELD

FAME
LAB

OCCUPATIONAL HEAT STRESS

Occupational heat stress = conditions under which a worker's body is storing heat



Harsh **environmental conditions**



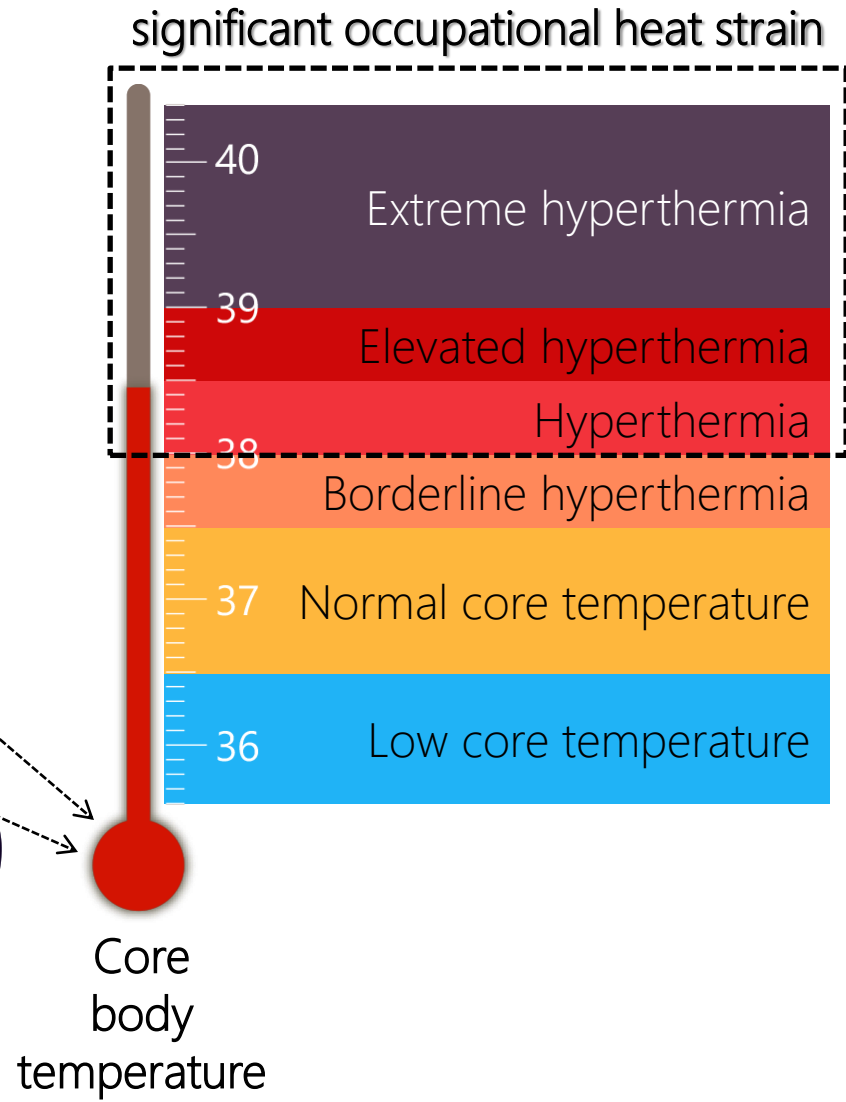
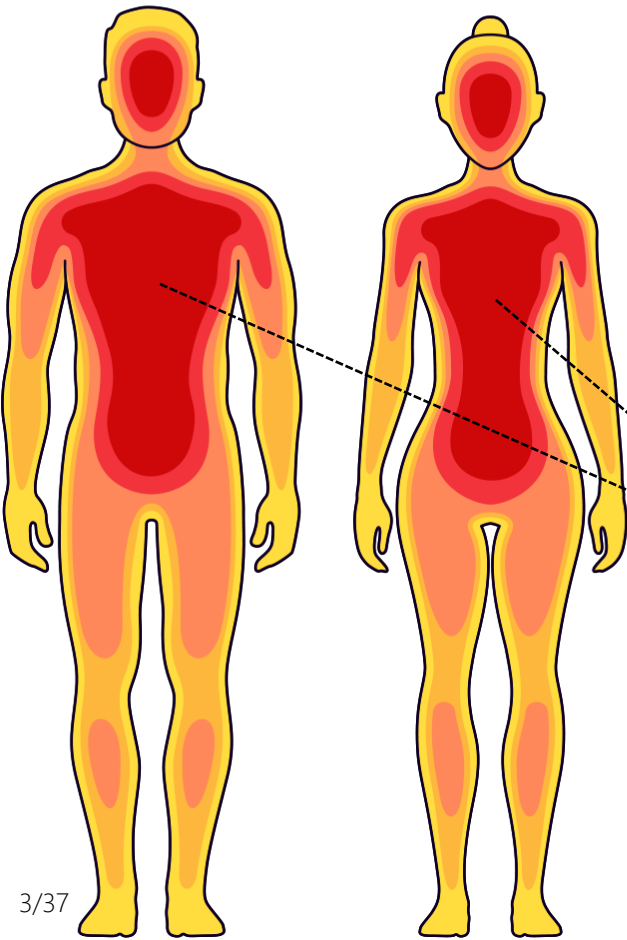
Insulated and/or impermeable **protective clothing**



Increased **metabolic heat** from physically demanding tasks

OCCUPATIONAL HEAT STRAIN

occupational heat stress leads to occupational heat strain



occurrence has dropped in many jobs due to mechanization and improved clothing technologies



Workers in physically demanding jobs and/or hot regions often experience heat strain which is typically not recognized

- 80 % of miners (Tanzania)

Meshi et al., 2018, Ann Glob Health

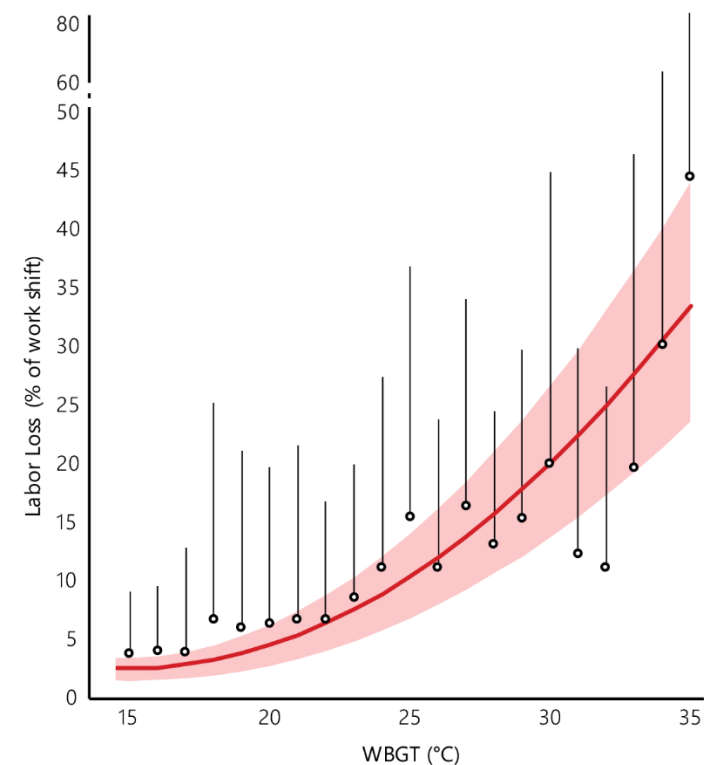
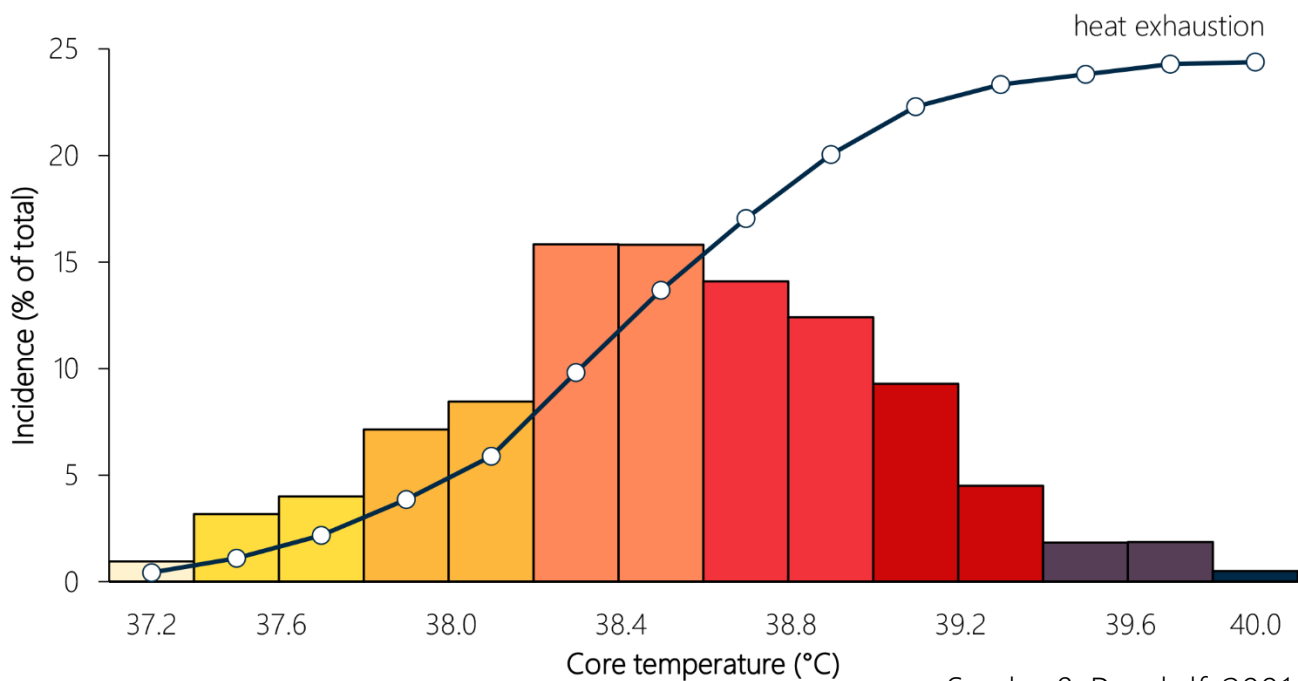
- 75 % electric utility workers (US)

Meade et al., 2015, J Occup Environ Hyg

occupational heat stress

raises the likelihood for heat-related pathologies

reduces productivity



Sawka & Pandolf, 2001

Ioannou et al., Under preparation

EXISTING GUIDELINES

SHORTCOMINGS &
CHALLENGES

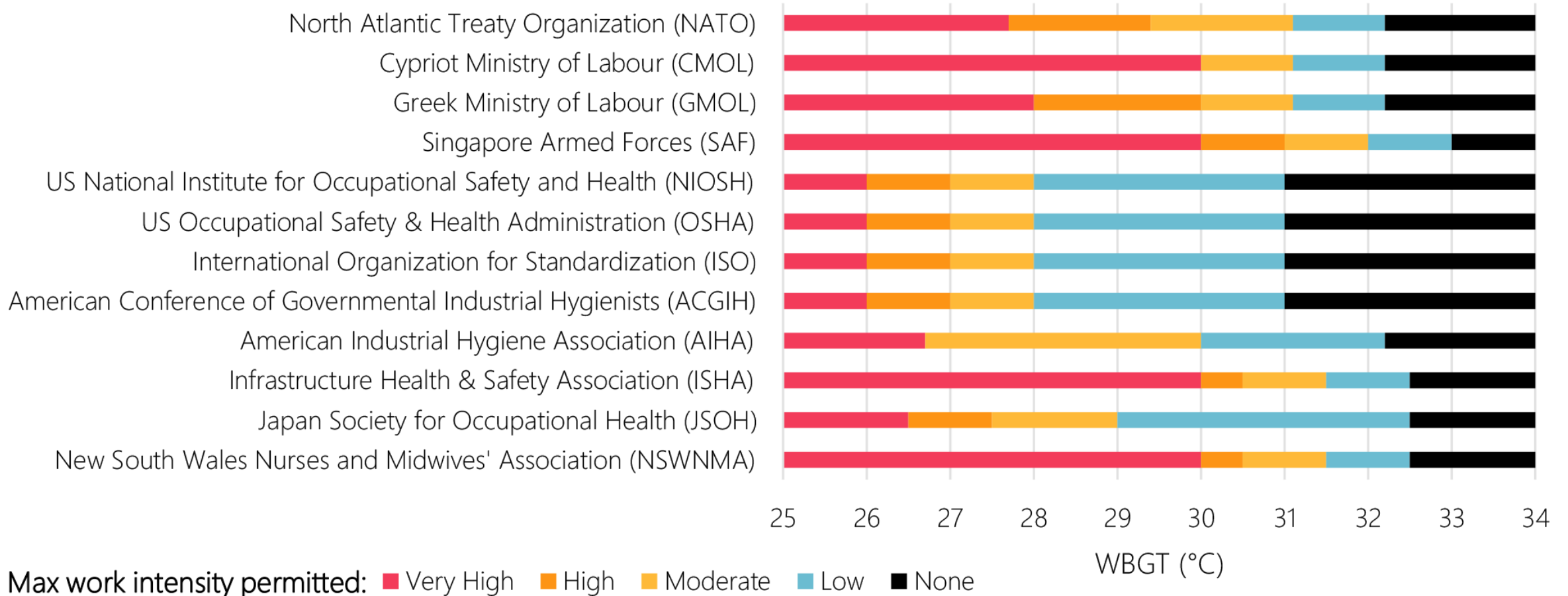
CONSIDERATIONS FOR
IMPROVING PROTECTION

TAKE HOME MESSAGES
ON GUIDANCE

EXISTING GUIDELINES

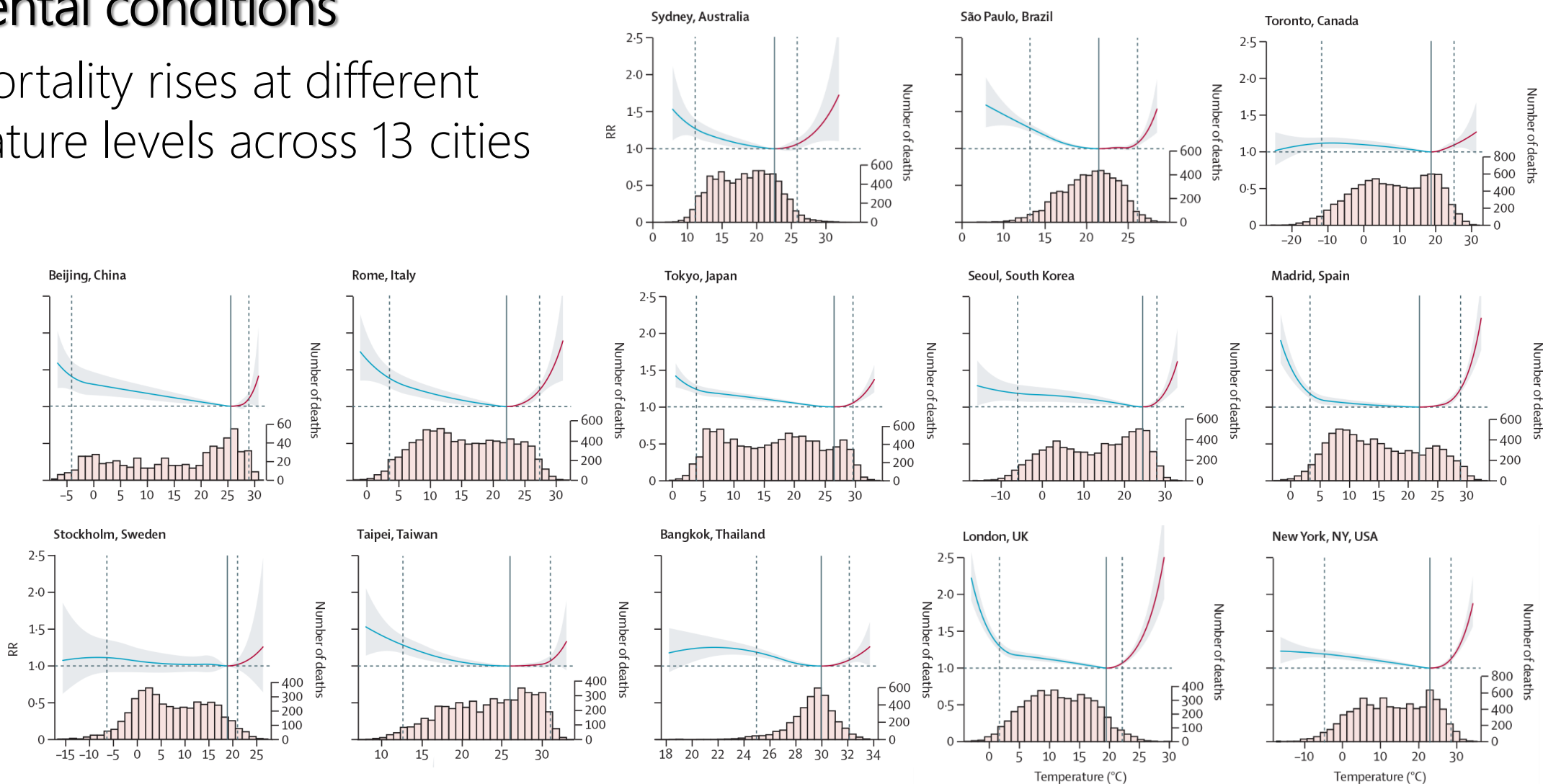
← Wet-Bulb Globe Temperature (**WBGT**) ---> largest evidence base for use in occupational settings

← **Thresholds** for work in hot environments based on WBGT:



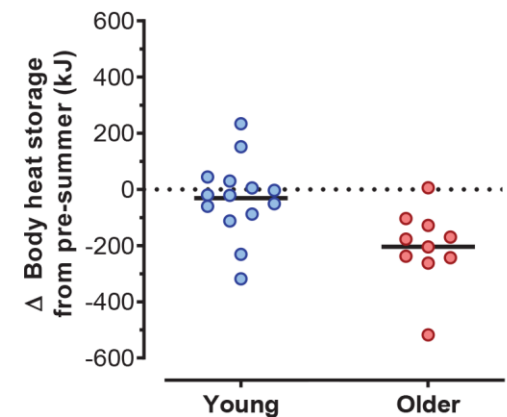
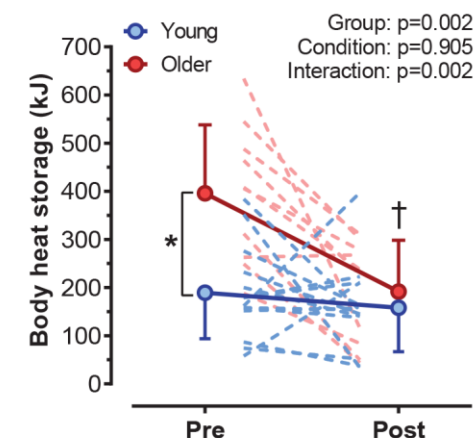
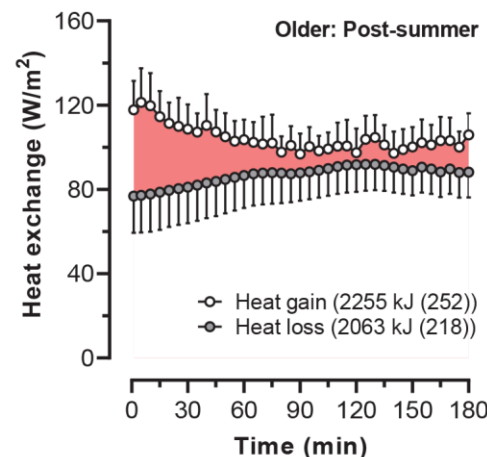
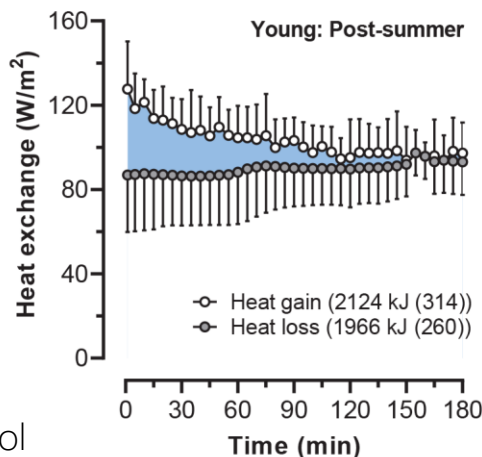
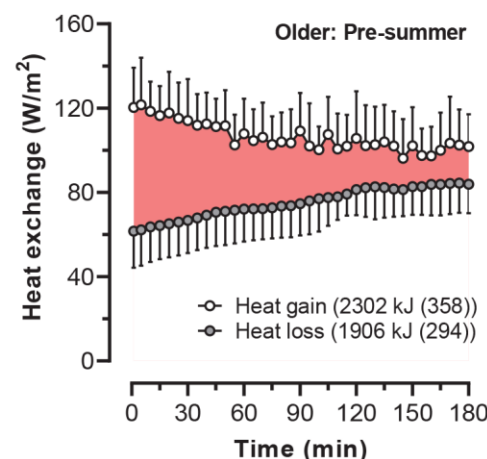
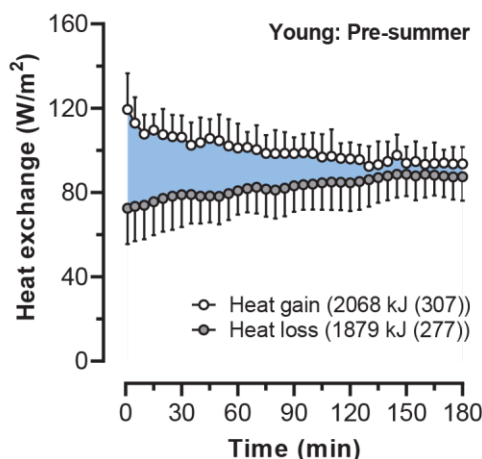
Populations living in different parts of the world **can acclimatize to the local environmental conditions**

– here, mortality rises at different temperature levels across 13 cities

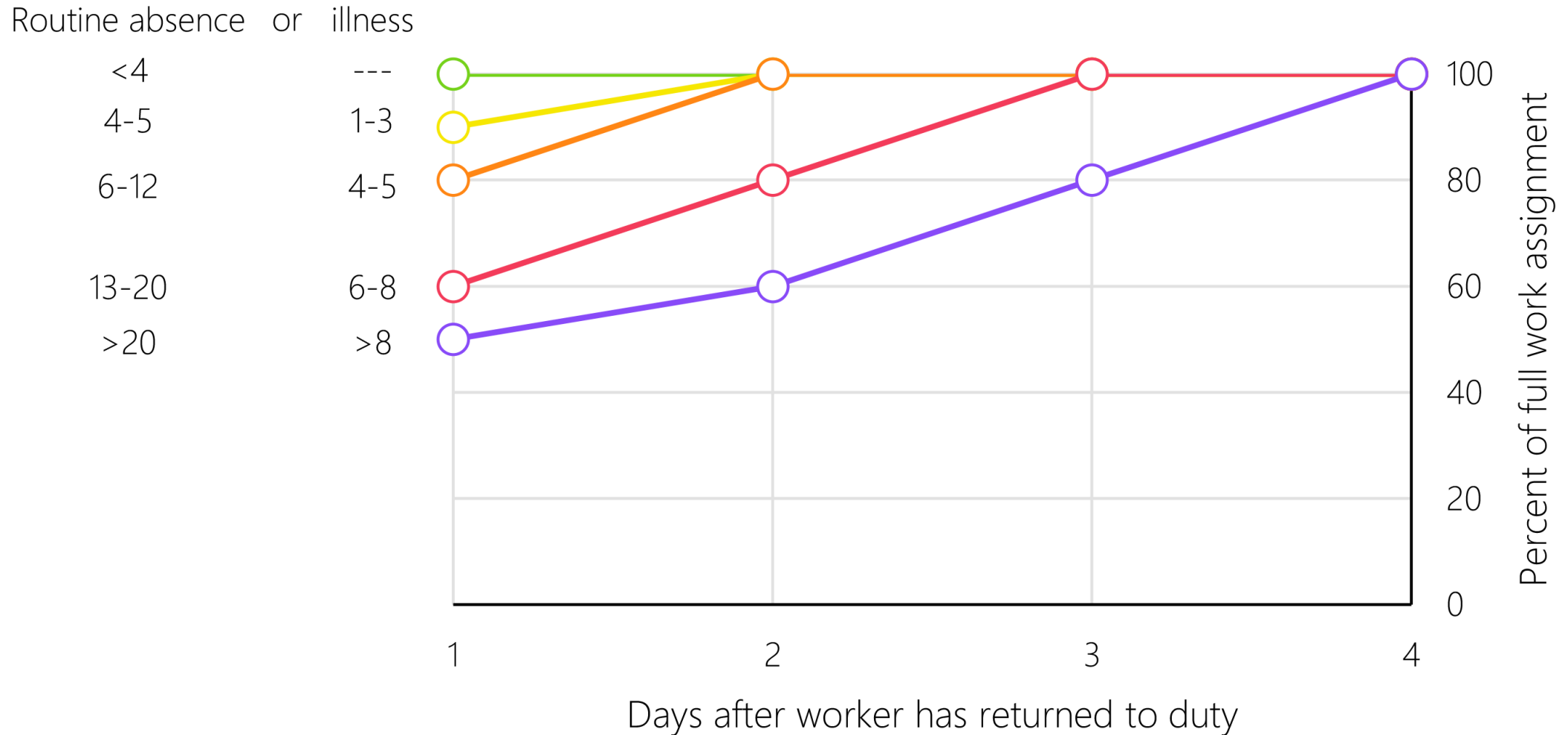


↳ **Natural acclimatization** occurring during the course of a summer reduces heat strain, particularly in older individuals (>55 years)

– here, heat storage was lower after the summer in older adults, but not in their young peers

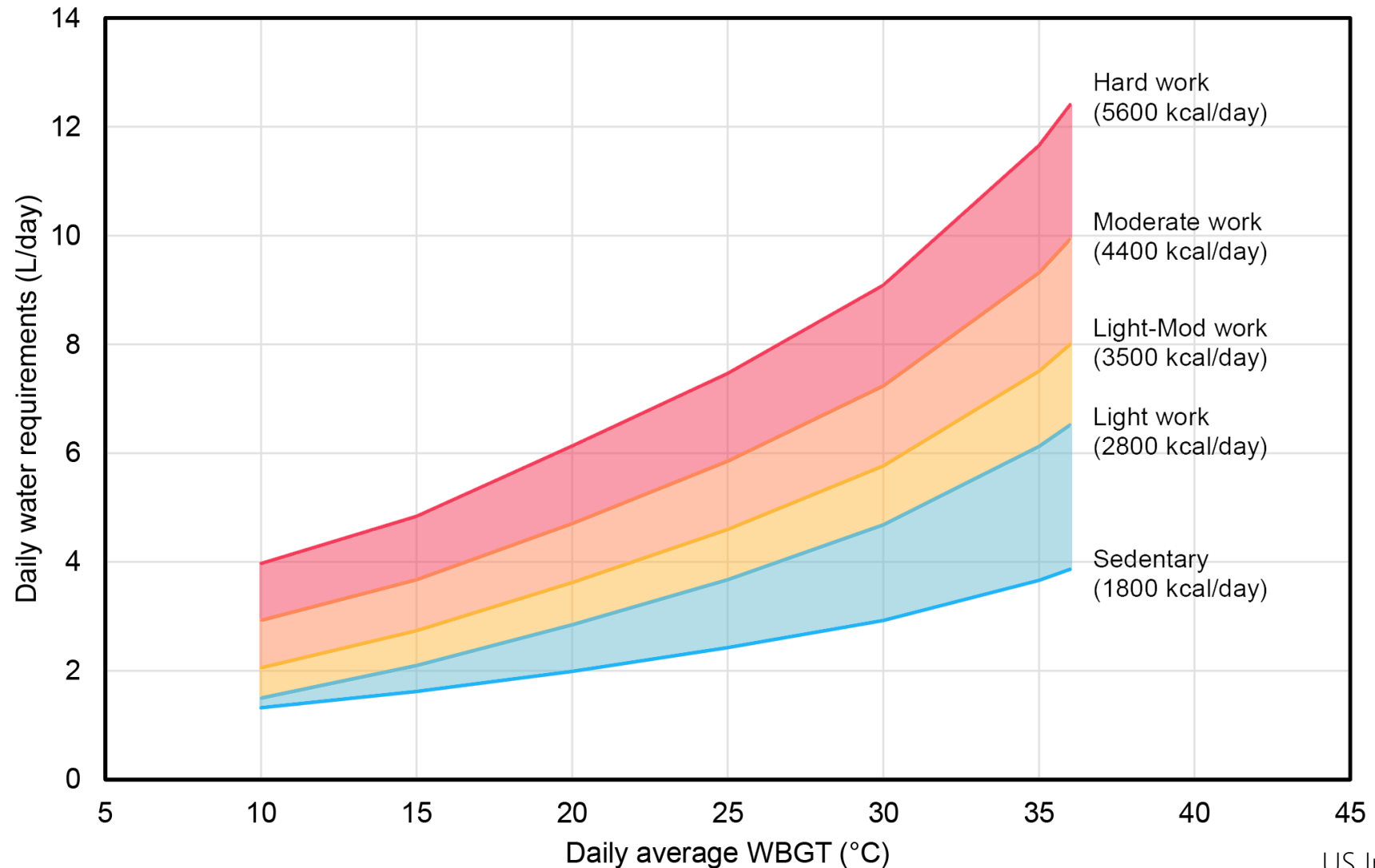


← **Re-acclimatization schedule** for work in the heat after routine absence or illness



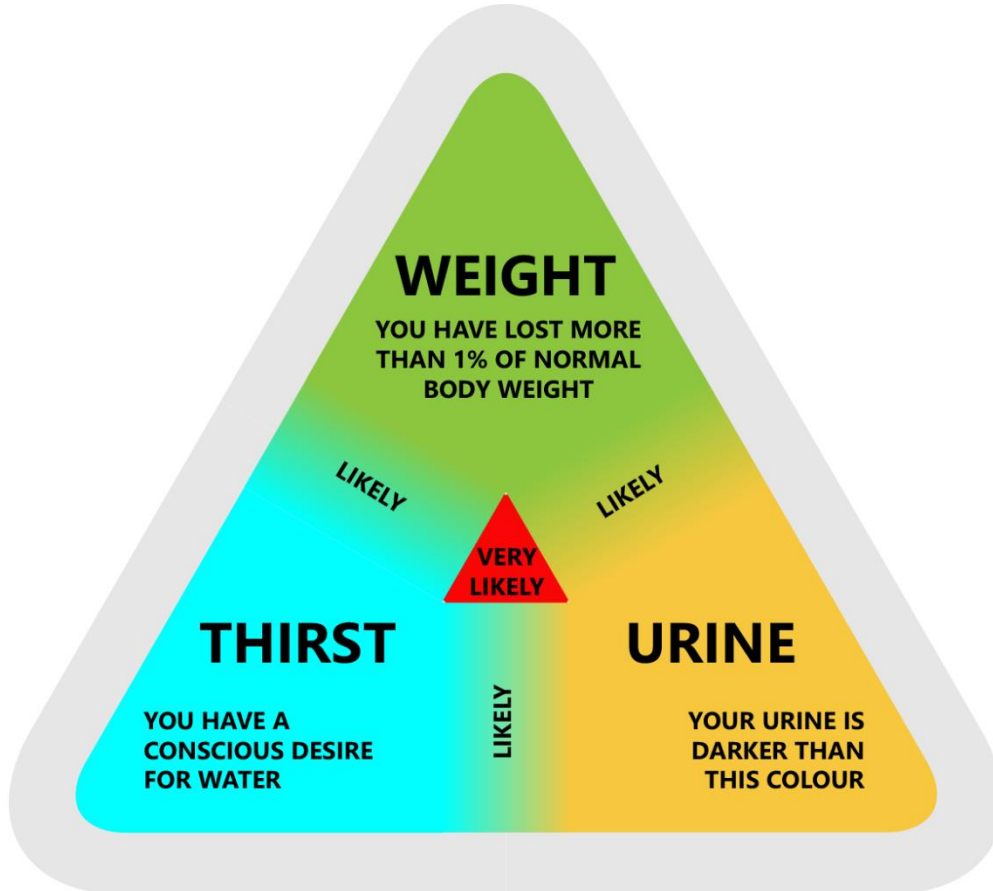
DAILY WATER REQUIREMENTS

← **Daily water requirements** for work in hot environments based on WBGT:



TOOLS TO MITIGATE HYPO-HYDRATION

Simple tools for detecting hypo-hydration and determining the adequacy of day-to-day water loss replacement in healthy, active, low-risk populations of workers



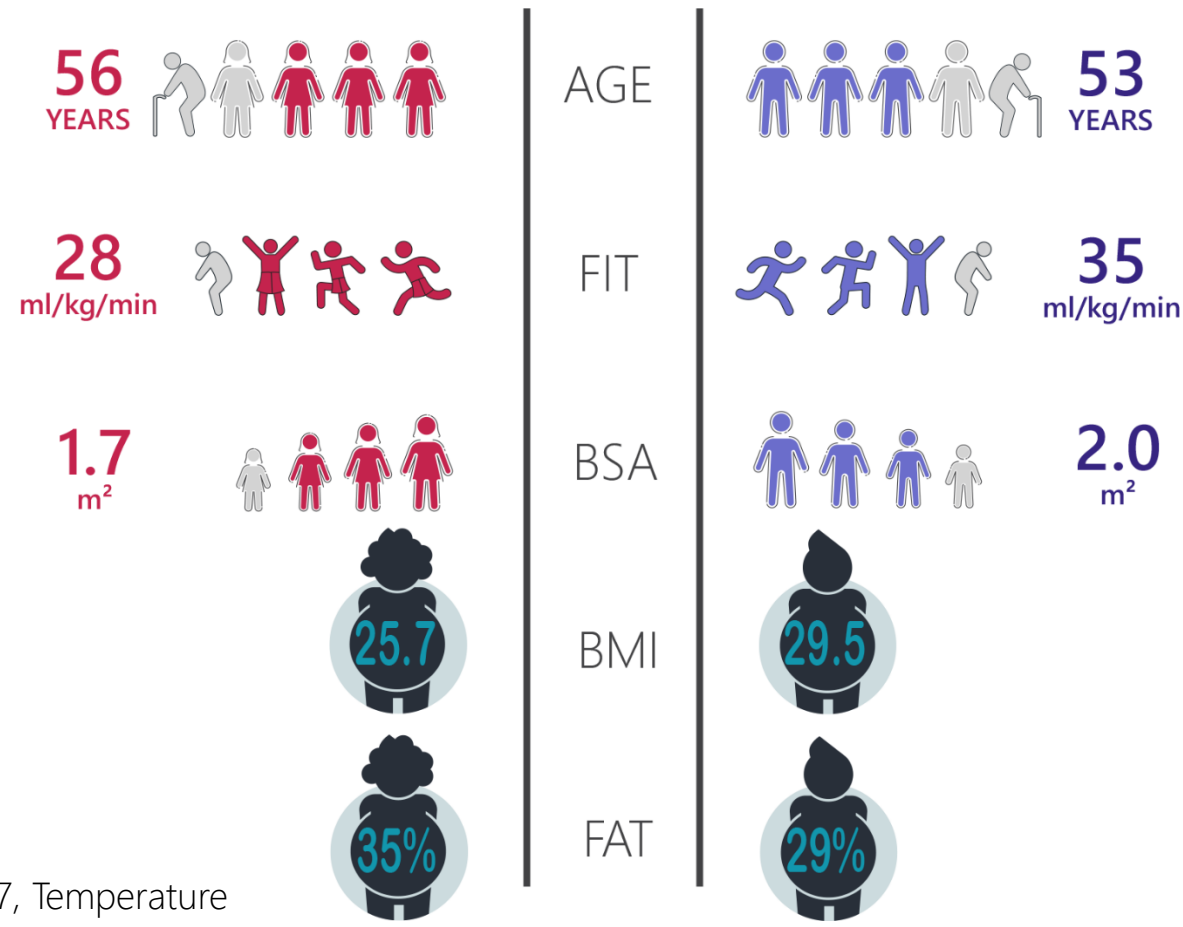
	Urine Colour	RGB Colour Code		
		Red	Green	Blue
Hydrated		255	243	173
		255	236	82
		247	200	62
		228	188	4
Hypohydrated		170	123	7
		141	81	21
		95	48	28
		73	36	20

SHORTCOMINGS & CHALLENGES

- ← **Older workers** are the fastest growing labour pool (EU Commission, 2018; CDC, 2012; Stats Canada, 2018)
- ← **Obesity** and **lack of physical fitness** have reached epidemic levels
- ← Prevalence of **chronic diseases** (e.g., diabetes) that affect thermoregulation is rapidly increasing

Notley et al., 2019, JAMA

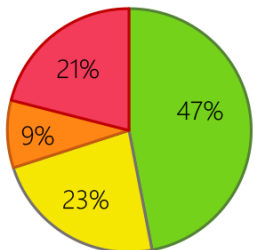
– here, thresholds for age, fitness, and body composition / morphology beyond which heat stress risk is higher



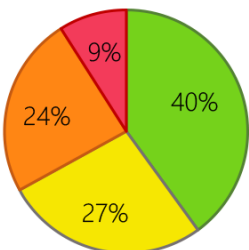
Flouris et al., 2017, Temperature

WORK RATE VARIES ACROSS JOBS & COUNTRIES

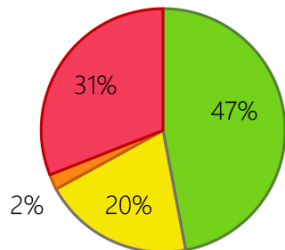
Mining (conventional)



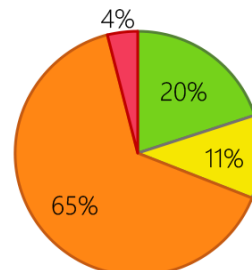
Mining (production drilling)



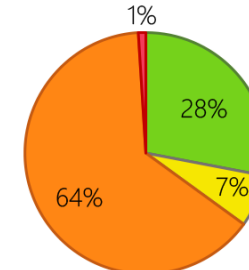
Electrical utilities (ground work)



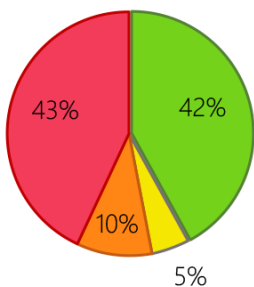
Agriculture (potato harvesting; Greece)



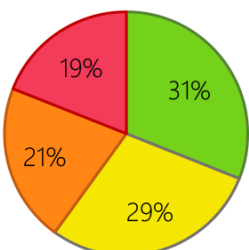
Construction (conventional; Spain)



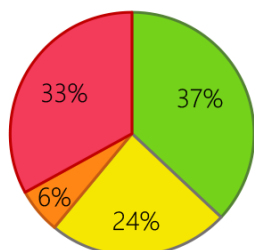
Mining (manual shotcrete)



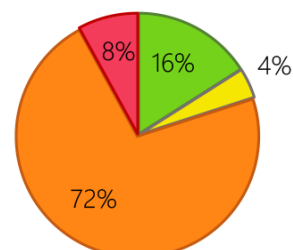
Mining (manual bolting)



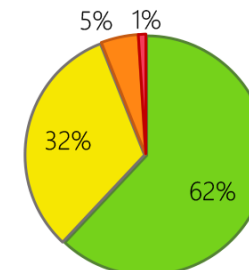
Electrical utilities (manual pole work)



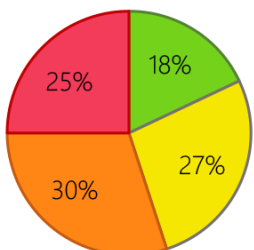
Agriculture (grape picking; Cyprus)



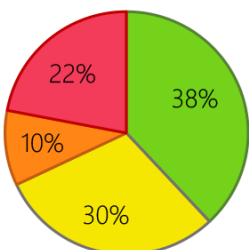
Construction (conventional; Qatar)



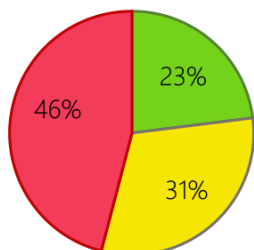
Mining (general services)



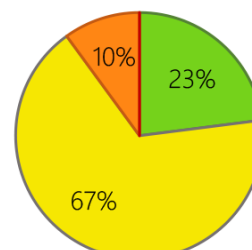
Mining (production ore transport)



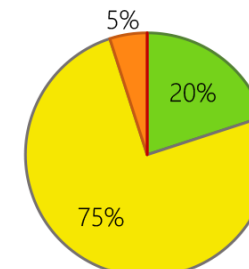
Electrical utilities (bucket work)



Agriculture (green fodder cultivating; Qatar)

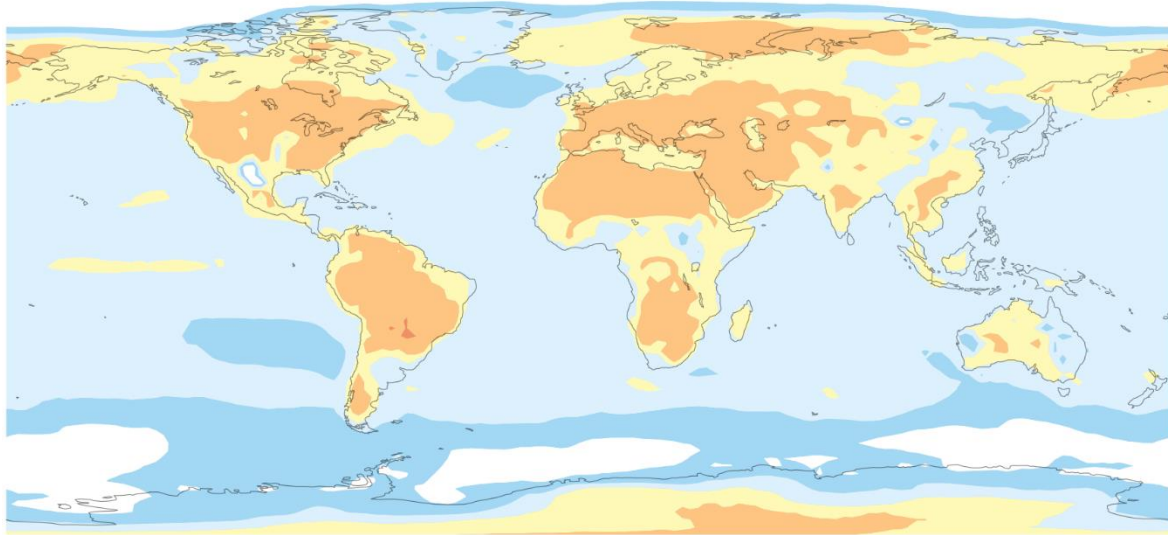


Tourism & services (conventional; Greece)

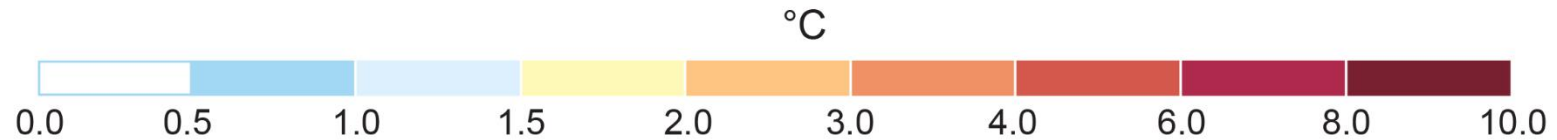
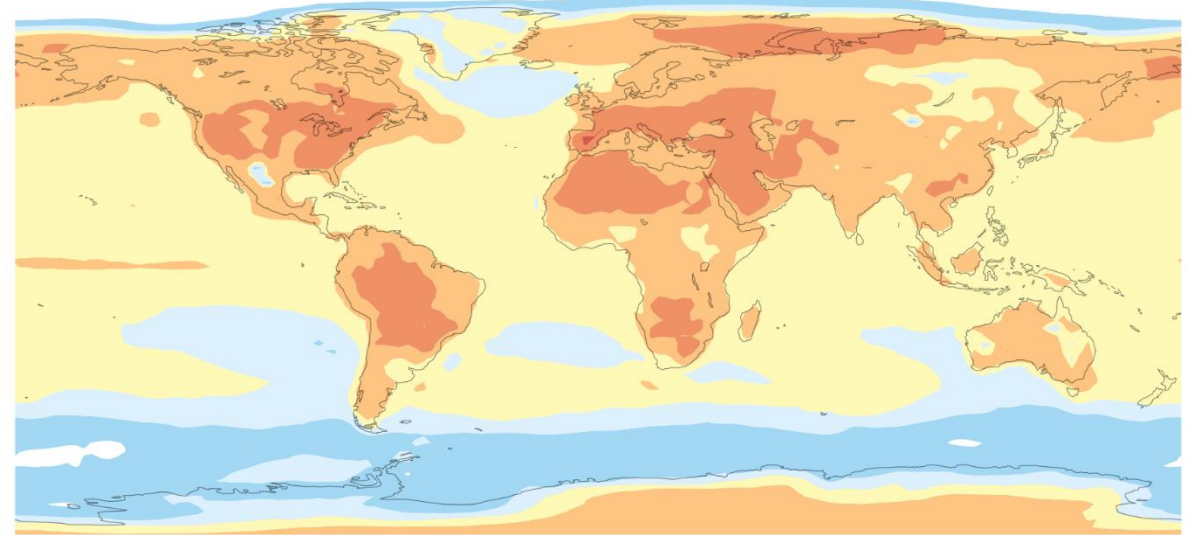


GLOBAL WARMING IS NOT UNIFORM ACROSS THE EARTH

+ 1.5°C: Change in average temperature of hottest days



+ 2.0°C: Change in average temperature of hottest days



CONSIDERATIONS FOR IMPROVING PROTECTION



↳ **Mission:** to address the negative impacts of workplace heat stress on the health and productivity of workers in strategic European industries



HEAT^o SHIELD

Funded by the EU Horizon 2020 research and innovation programme (no.668786)

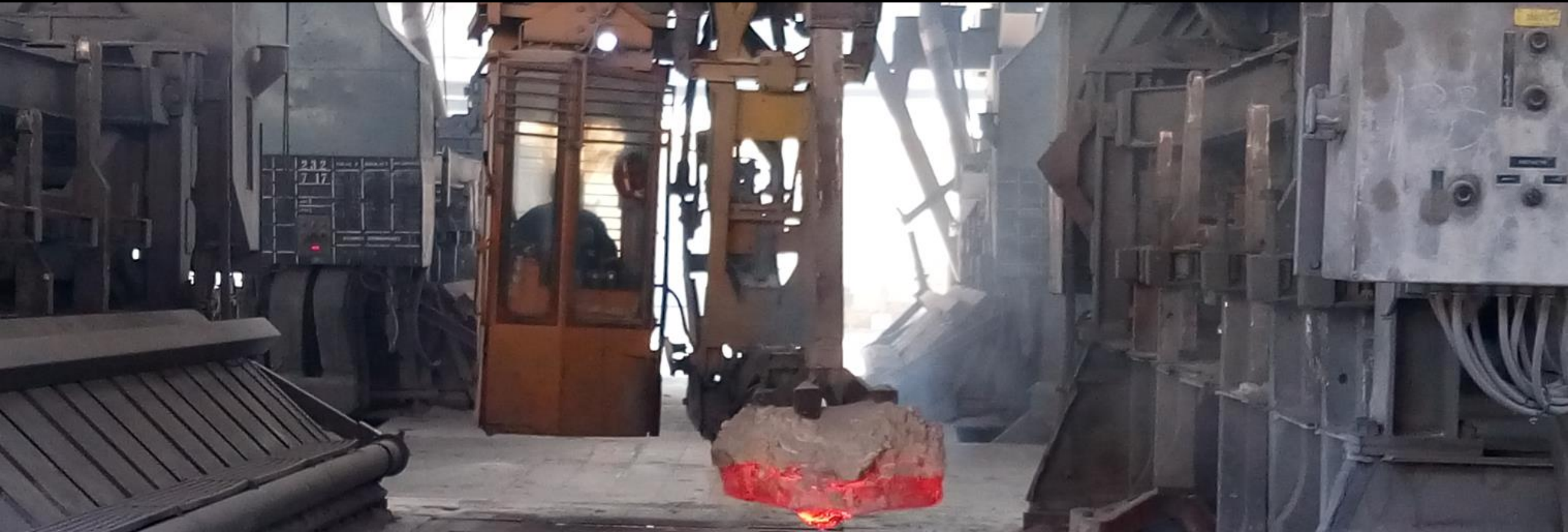


← **Mission:** to develop and evidence-based heat mitigation plan for Qatar



International Labour Organization

Funded by the ILO Office of Qatar (no. 40262271/1)



← **Mission:** assessing and managing occupational heat stress risk in Greek industries



ΥΠΟΥΡΓΕΙΟ ΕΡΓΑΣΙΑΣ &
ΚΟΙΝΩΝΙΚΩΝ ΥΠΟΘΕΣΕΩΝ

Supported by the Greek Ministry of Labour and Social Affairs



↳ **Mission:** understanding heat stress for workers in the electric power industry and providing recommendations for mitigation (work with Dr. Glen Kenny at Univ. Ottawa)

↳ Adaptation strategies

work-rest ratios



hydration



mechanization



clothing



↳ Vulnerable workers

↳ Personalized warning system

← Online platform providing forecasts and guidance up to 30 days in advance

← Designed for **workers** and **employers**

The screenshot shows the HEAT SHIELD website interface. At the top, there is a navigation bar with the HEAT SHIELD logo, a home icon, and links for REGISTERED USER, NEW USER, CONTACTS, and ENGLISH. Below the navigation bar, there are two main sections: "Forecast" and "The Project".

Forecast Section:

- Navigation tabs: WEEK 1, WEEK 2, WEEK 3, WEEK 4.
- Title: Forecast for Mon 26.11 - Sun 2.12.2018, issued on 19.11.2018.
- Map: A map of Europe with numerous green dots indicating the risk of hot days. A legend on the left shows a color scale for "Risk of hot* days" from 0% (green) to 100% (red).
- Footnote: * WBGTsun > 27 °C.
- Copyright: © MeteoSwiss based on ECMWF forecast of 19.11.2018.

The Project Section:

- HEAT SHIELD logo.
- Text: Heat stress depends on the weather as well as your individual physiology and working conditions.
- Diagram: A central figure of a worker in a hard hat and safety vest, surrounded by four arrows pointing towards it:
 - Weather:** Air temperature, humidity, air speed, radiant surfaces.
 - Work Rate:** Strenuous work, when and how often breaks scheduled.
 - Clothing:** Personal Protective Equipment (PPE).
 - The Individual:** Acclimatisation, age, medical conditions.
- Text: Use the advanced Heat-Shield alert system and get scenario specific and personalized forecasts, advice on hydration, how to minimize heat load, solutions for specific industries...
- Button: READ MORE.

At the bottom of the forecast section, there is a button labeled "USE WEB VERSION".

Personalized heat alerts and rest /hydration advice

HEAT SHIELD


Already registered? [Insert email and password](#)

LOGIN

[« Home](#)

[Forgot password?](#)

 Worker
Create your profile

 Stakeholder
Create your profile

English

BUILD YOUR PROFILE

Be kind. This informations will let us calculate your **heat alert threshold**.

PROFILE

HEALTH

LOCATION

JOB

Let's start with the basic information

Email (required)

m.morabito@ibimet.cnr.it

Password (required)

.....

Street Name

Nr

ZIP

City

Country (EU)

select

NEXT

By



Forecast • Dashboard U.C.

Short term heat stress risk

Wednesday

☹️☹️☹️
☹️

05/22/2019

Thursday

☹️☹️☹️
☹️

05/23/2019

Friday

☹️☹️☹️
☹️☹️

05/24/2019

Saturday

☹️☹️☹️
☹️☹️

05/25/2019

Sunday

☹️☹️☹️
☹️☹️

05/26/2019

HEAT STRESS RISK LEVELS

- NOT SIGNIFICANT +
- LOW +
- MODERATE +
- HIGH +

Hydratation

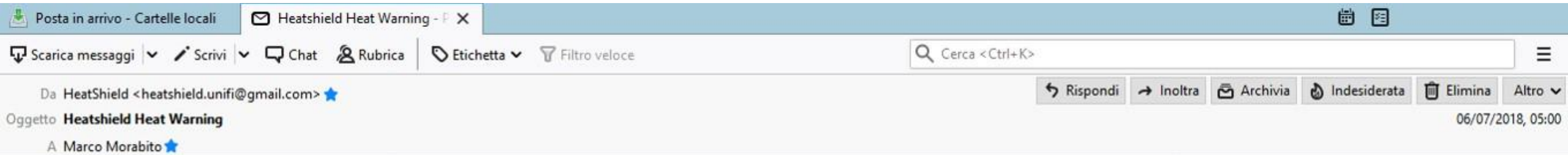
- ☹️ drink about half a liter of water per hour
- ☹️☹️ drink about a liter per hour
- ☹️☹️☹️ drink more than a liter of water per hour

Work breaks

- ☹️ no further breaks are needed
- ☹️☹️ small breaks
- ☹️☹️☹️ increase the number of breaks with cooling
- ☹️☹️☹️☹️ frequent breaks in shadow or cooled area

LONG TERM RISK

EDIT PROFILE



According to your profile's features, the heat stress threshold is expected to exceed in the next five days, in the area you selected

Please check the suggestions indicated in your [profile](#)

Heat Shield Staff

Long term heat stress risk

Mon	Tue	Wed	Thu	Fri	Sat	Sun
05/27/2019	05/28/2019	05/29/2019	05/30/2019	05/31/2019	06/01/2019	06/02/2019
Mon	Tue	Wed	Thu	Fri	Sat	Sun
06/03/2019	06/04/2019	06/05/2019	06/06/2019	06/07/2019	06/08/2019	06/09/2019
Mon	Tue	Wed	Thu	Fri	Sat	Sun
06/10/2019	06/11/2019	06/12/2019	06/13/2019	06/14/2019	06/15/2019	06/16/2019
Mon	Tue	Wed	Thu	Fri	Sat	Sun
06/17/2019	06/18/2019	06/19/2019	06/20/2019	06/21/2019	06/22/2019	06/23/2019
Mon	Tue	Wed	Thu	Fri	Sat	Sun
06/24/2019	06/25/2019	06/26/2019	06/27/2019	06/28/2019	06/29/2019	06/30/2019
Mon	Tue					
07/01/2019	07/02/2019					

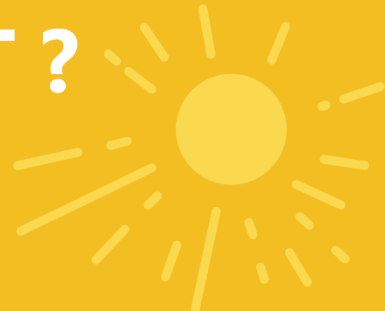
HEAT STRESS RISK LEVELS

NOT SIGNIFICANT	+
LOW	+
MODERATE	+
HIGH	+

WORKING IN THE HEAT ?

Dehydration is a serious threat to your health

Hydration is about maintaining your body's water and electrolytes stores by ingesting fluid and salt to match the amounts you lose through sweating



70%
OF EUROPEANS WORKING IN
HIGH HEAT ARE DEHYDRATED



THIRST DOES IT PROTECT ?

Thirst may not be sufficient
to secure that you stay
hydrated in hot conditions



WATER AND SALT

Read these steps to
secure adequate daily
water and salt intake

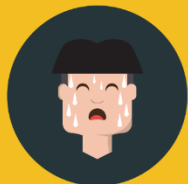
HABITS DAY-TO-DAY

It is not only about
hydrating at work. Hydrating
at home is equally important



BALANCE

Find your balance.
Hydration needs vary
from person to person



SWEAT LOSS

Your water needs
may be high if you
are a "heavy-sweater"



ELECTROLYTES

If your blood pressure
is normal, extra salt to
your meals may help



STAY PROTECTED

Get support personalized
to your needs at
www.heat-shield.eu

Agriculture

OCCUPATIONAL HEAT STRESS IN AGRICULTURE
How to stay safe and productive in hot weather

What you need to do: 1. Drink water regularly, 2. Wear protective clothing, 3. Take breaks in shade, 4. Use cooling vests, 5. Acclimatize to heat.

Construction

OCCUPATIONAL HEAT STRESS IN CONSTRUCTION
How to stay safe and productive in hot weather

What you need to do: 1. Drink water regularly, 2. Wear protective clothing, 3. Take breaks in shade, 4. Use cooling vests, 5. Acclimatize to heat.

Manufacturing

OCCUPATIONAL HEAT STRESS IN MANUFACTURING
How to stay safe and productive in hot working environments

What you need to do: 1. Drink water regularly, 2. Wear protective clothing, 3. Take breaks in shade, 4. Use cooling vests, 5. Acclimatize to heat.

Tourism

OCCUPATIONAL HEAT STRESS IN TOURISM
How to stay safe and productive in hot working environments

What you need to do: 1. Drink water regularly, 2. Wear protective clothing, 3. Take breaks in shade, 4. Use cooling vests, 5. Acclimatize to heat.

Transportation

OCCUPATIONAL HEAT STRESS IN TRANSPORTATION
How to stay safe and productive in hot working environments

What you need to do: 1. Drink water regularly, 2. Wear protective clothing, 3. Take breaks in shade, 4. Use cooling vests, 5. Acclimatize to heat.



HEAT AFFECTS YOUR HEALTH AND PRODUCTIVITY

HOT FACTs upon which you can **ACT** to minimize the detrimental effects on your organization's performance



ACCIDENTS - WORKERS' HEALTH - ORGANIZATION PERFORMANCE



Heat stress impairs physical and mental work capacity



Substantial productivity losses surpassing 15% on hot days



Heat increases work injuries, leads to accumulated fatigue & acute sickness



Frequent work in the heat causes chronic health hazards (e.g., doubled risk of kidney disease)

Request the development of a heat mitigation plan for your organization



Create a buddy system and take breaks (e.g., 2-5 min per hour) that protect health and maintain productivity



Ensure your work uniform is safe, comfortable, and made from breathable fabrics that reflect radiation



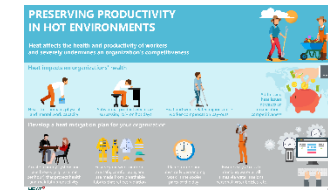
Plan outdoor and physically demanding work in the cooler parts of the day



Ensure easy access to drinking water at all times via water stations, personal water bottles, etc.



Employers



OHS experts



TAKE HOME MESSAGES ON GUIDANCE

- ← Employers should prepare and have available at the work site a copy of their **risk assessment and heat mitigation plan**
- ← Employers should ensure that all employees undergo **initial medical examination** upon recruitment followed by **annual health checkups** to prevent, diagnose, and manage chronic disease and assist workers to remain fit for duty, considering in particular conditions and symptoms related to work in hot environments
- ← Employers should ensure that **medical, safety, and welfare staff are readily available for support and care**

- ← Employers should **provide training** (upon recruitment and at the start of each summer period) to all employees on occupational heat stress

Recommended actions:

- ← **Training should cover** the impacts of physical exertion, clothing, personal protective equipment, dehydration, and sleep deprivation, as well as on first aid and how to observe their colleagues for alertness and signs or symptoms of heat-related illness
- ← Employers should **reinforce these messages** using large signs throughout the work site in the workers' languages
- ← Employers should **train supervisors** on how to monitor weather reports and how to respond to heat advisories. These training procedures should include designating a person to be available to ensure that **emergency procedures** are invoked when appropriate
- ← Employers should **closely supervise newly recruited employees**, particularly for the first 14 days of their employment. This is especially important for workers who have been recruited during the summer season and are not been acclimatized

- ↳ Employers should ensure that all employees have free and continuous **access to fresh, pure, and suitably cool drinking water** throughout the work shift

Recommended actions:

- ↳ Maintaining one or more **water stations** located as close as practicable to where employees are working, and in no case at a distance that employees cannot reach within 5 minutes
- ↳ Providing each outdoor worker with a **water bottle** to carry with them throughout their work shift
- ↳ Frequently reminding employees to **drink water on a regular basis** and to re-fill the water bottle when needed
- ↳ Employers should **adopt practical tools** for diagnosing hypo-hydration and should provide employees with training regarding their usage

- ↳ Employers with outdoor places of employment should provide **access to shade**

Recommended actions:

- ↳ Maintaining one or more **shaded areas** sufficient to accommodate 25 percent of the employees on the work shift at any time, located as close as practicable to where employees are working, within a distance that employees can reach within 5 minutes
- ↳ Providing **air-conditioned rest areas** to be used during breakfast / lunch / dinner breaks that are large enough to fit all workers in each work shift
- ↳ The cool parts of the day **should be prioritized** when performing outdoor work to limit occupational heat stress exposure

- ↳ Employers should provide workers appropriate personal protective equipment, including loose, light-coloured, and durable **clothing** made from breathable fabrics to maximize heat evaporation
- ↳ Employees should be encouraged to **take a break** for cooling-down in the shade if they feel they need to do so to protect themselves from overheating

EVIDENCE-BASED GUIDELINES TO BOOST HEALTH AND WORK PRODUCTIVITY IN A WARMING WORLD

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European
Commission

Horizon 2020
European Union funding
for Research & Innovation

HEAT^o SHIELD

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