Heat effects on workers in Europe

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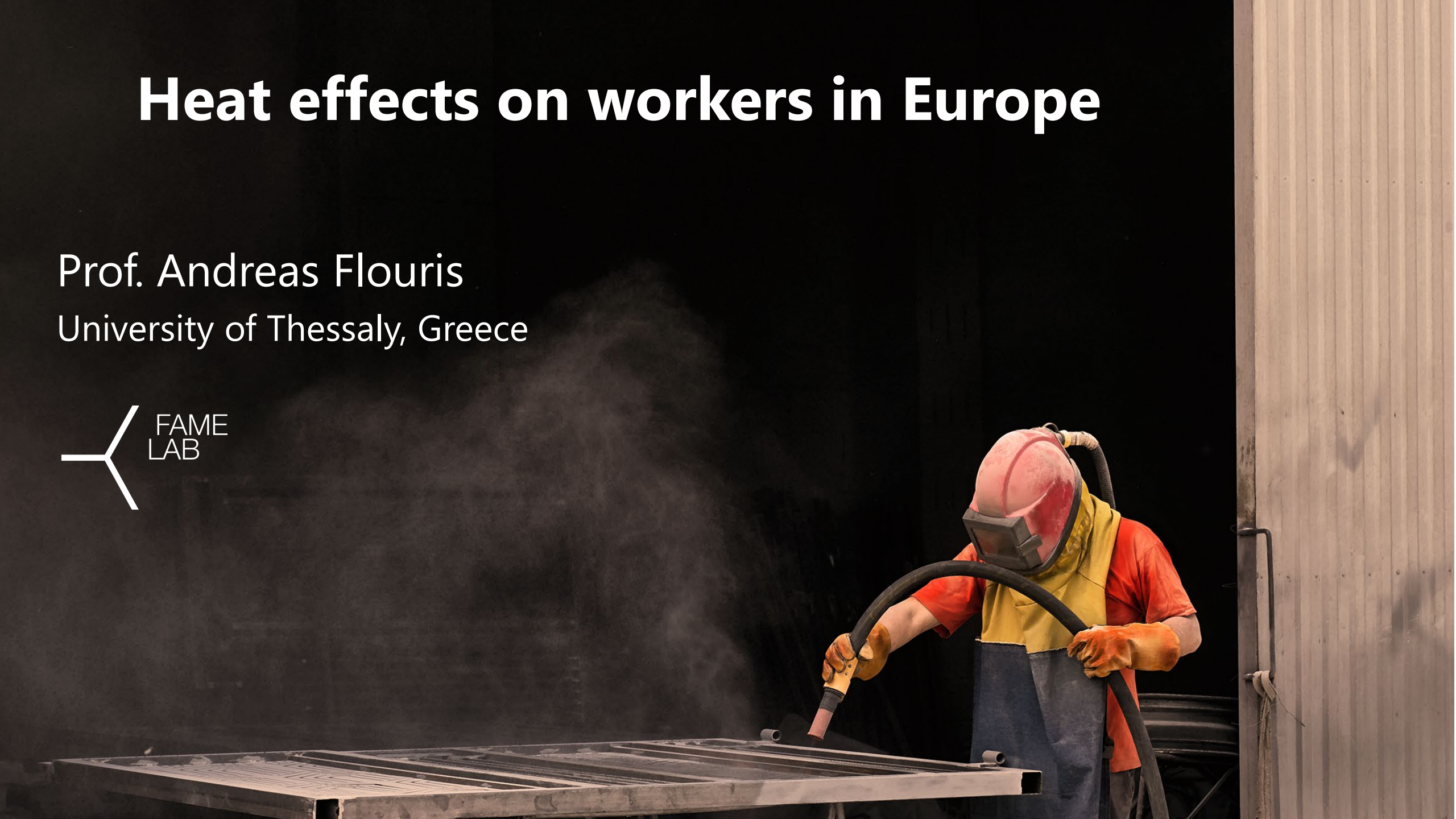

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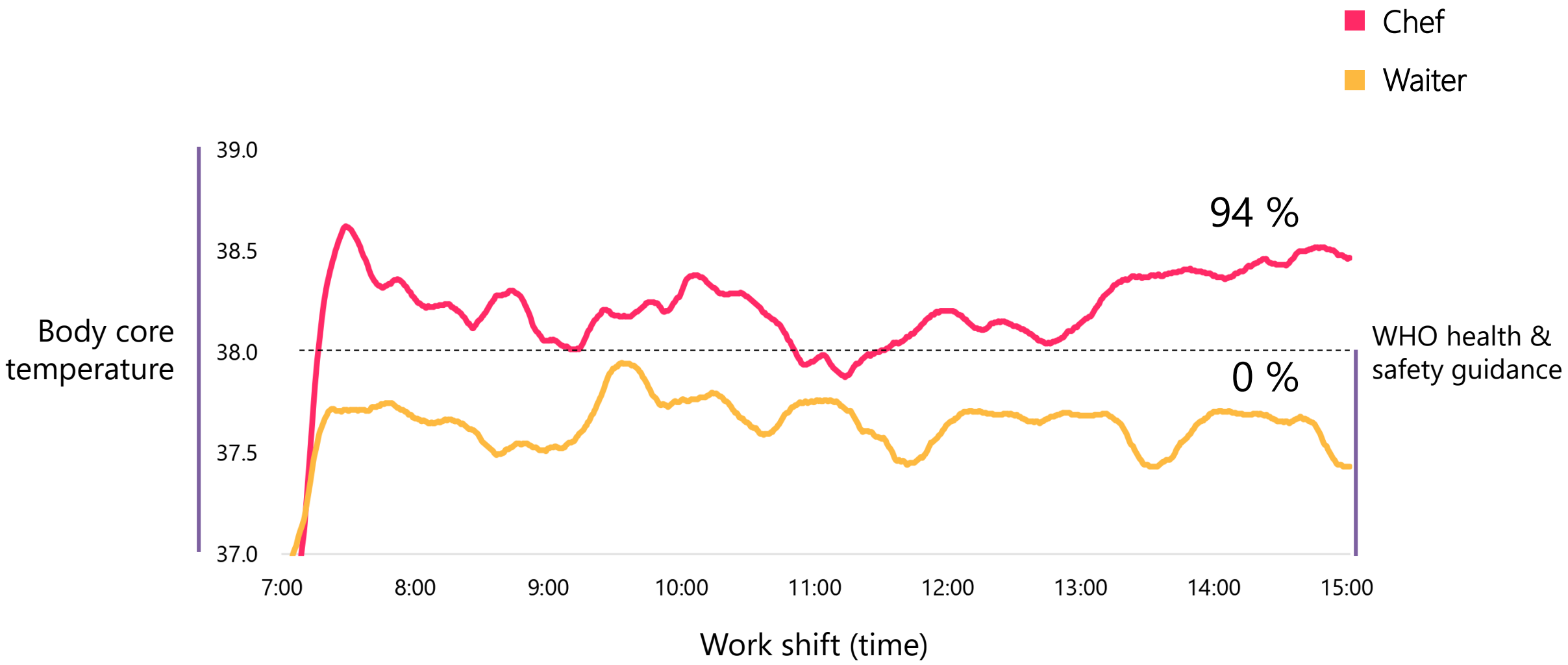
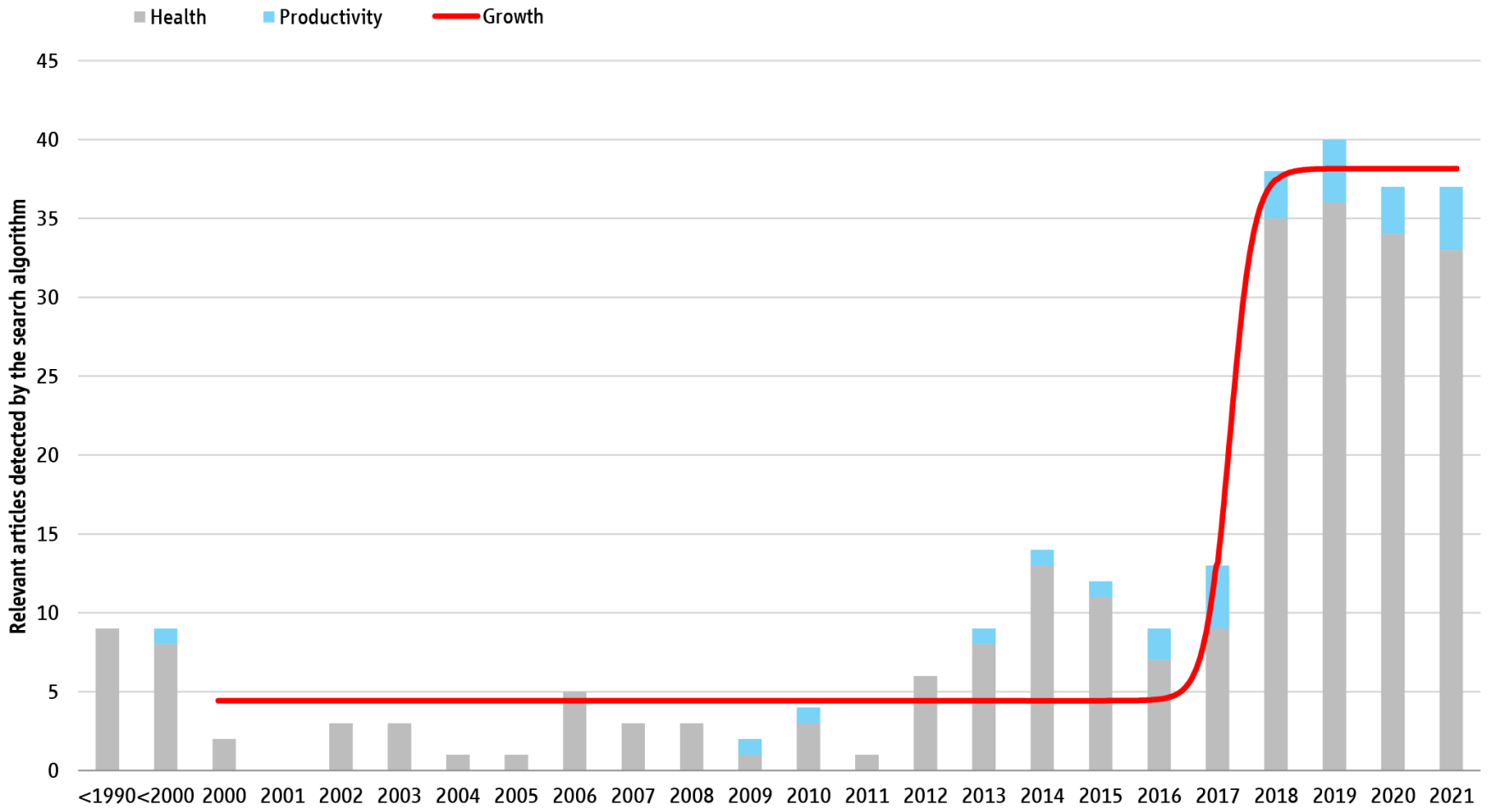
Occupational heat stress creates inequalities



Occupational heat stress literature is growing

- Up to 2015, the literature on occupational heat stress comprised of **87 studies**
- **71% of studies** on occupational heat stress have been <u>published after 2015</u>



Flouris et al., 2022; Temperature

Addressing the lack knowledge in Europe

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

European Commission | Horizon 2020 European Union funding for Research & Innovation

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Field studies across Europe

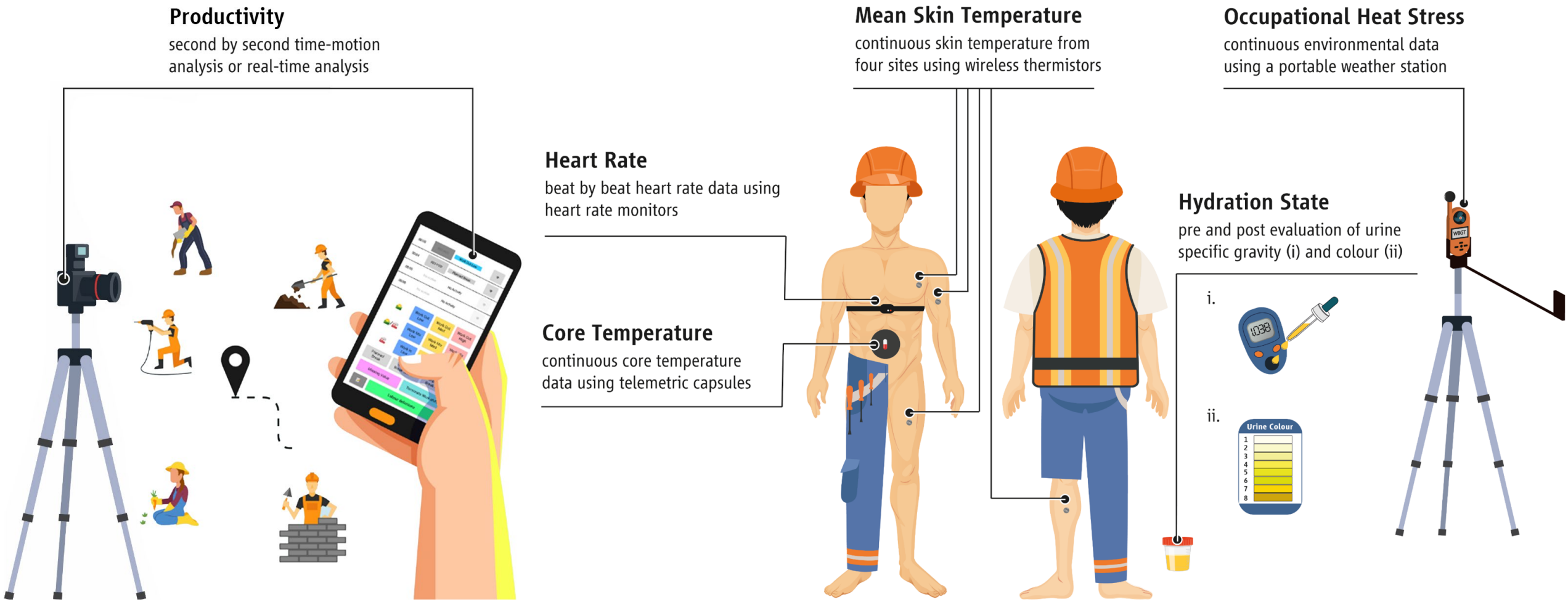
- **HEAT-SHIELD mission:** to address the negative impacts of workplace heat stress on the health and productivity of workers in strategic European industries

tourism	agriculture	manufacturing	construction	transportation
				
GREECE CYPRUS	CYPRUS ITALY GREECE SLOVENIA	SLOVENIA DENMARK GREECE	SPAIN ITALY	SWITZERLAND PORTUGAL GREECE

Our approach in field research

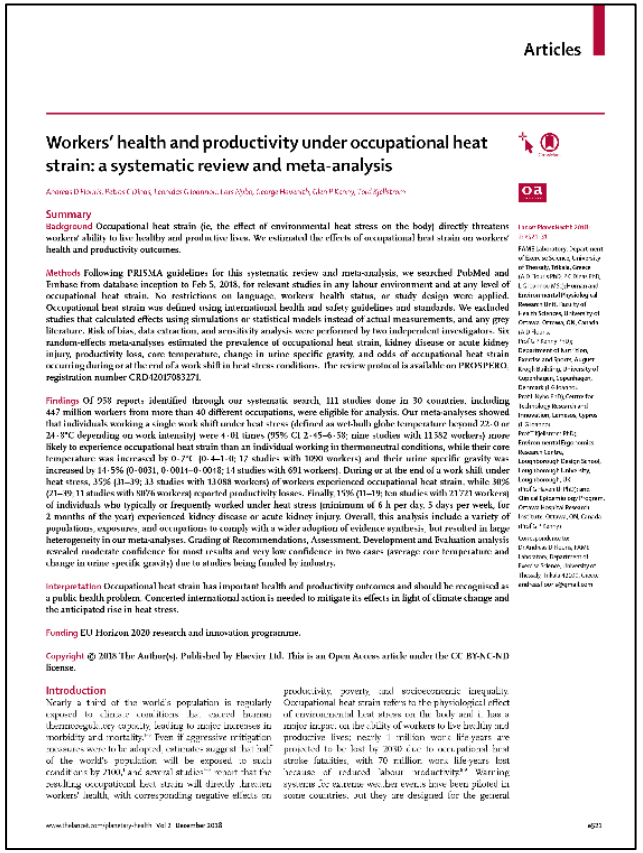
Productivity assessment

Health assessment



Health impacts of occupational heat stress

- During or at the end of a single work shift in heat stress conditions
  - **35%** of workers experience symptoms of physiological strain
- Mild
  - heat rash
  - heat syncope (dizziness/fainting)
- Severe
  - heat exhaustion
  - heat stroke
  - fluid/electrolyte imbalances
  - acute/chronic kidney injury



Articles

Workers' health and productivity under occupational heat strain: a systematic review and meta-analysis

Summary

Background Occupational heat strain (ie, the effect of environmental heat stress on the body) directly threatens workers' ability to live healthy and productive lives. We estimated the effects of occupational heat strain on workers' health and productivity outcomes.

Methods Following PRISMA guidelines for this systematic review and meta-analysis, we searched PubMed and Embase from database inception to Feb 5, 2018, for relevant studies in any labour environment and at any level of occupational heat strain. No restrictions on language, workers' health status, or study design were applied. Occupational heat strain was defined using international health and safety guidelines and standards. We excluded studies that calculated effects using simulations or statistical models instead of actual measurements, and any grey literature. Risk of bias, data extraction, and sensitivity analysis were performed by two independent investigators. Six random-effects meta-analyses estimated the prevalence of occupational heat strain, kidney disease or acute kidney injury, productivity loss, core temperature, change in urine specific gravity, and odds of occupational heat strain occurring during or at the end of a work shift in heat-stress conditions. The review protocol is available on PROSPERO, registration number CRD42017083271.

Findings Of 938 reports identified through our systematic search, 111 studies done in 30 countries, including 447 million workers from more than 40 different occupations, were eligible for analysis. Our meta-analyses showed that individuals working a single work shift under heat stress (defined as wet-bulb globe temperature beyond 22·0 or 24·9°C depending on work intensity) were 4·01 times (95% CI 2·45–6·58; nine studies with 11 352 workers) more likely to experience occupational heat strain than an individual working in thermoneutral conditions, while their core temperature was increased by 0·27°C (0·24–0·31; 17 studies with 1090 workers) and their urine specific gravity was increased by 11·35% (0·0031, 0·0014–0·0048; 14 studies with 691 workers). During or at the end of a work shift under heat stress, 35·2% (21–49; 13 studies with 11 088 workers) of workers experienced occupational heat strain, while 30·5% (23–39; 11 studies with 8076 workers) reported productivity losses. Finally, 19·% (11–29; ten studies with 21 721 workers) of individuals who typically or frequently worked under heat stress (minimum of 6 h per day, 5 days per week, for 2 months of the year) experienced kidney disease or acute kidney injury. Overall, this analysis include a variety of populations, exposures, and occupations to comply with a wider adoption of evidence synthesis, but resulted in large heterogeneity in our meta-analyses. Grading of Recommendations, Assessment, Development and Evaluation analysis revealed moderate confidence for most results and very low confidence in two cases (average core temperature and change in urine specific gravity) due to studies being funded by industry.

Interpretation Occupational heat strain has important health and productivity outcomes and should be recognised as a public health problem. Concerted international action is needed to mitigate its effects in light of climate change and the anticipated rise in heat stress.

Funding EU Horizon 2020 research and innovation programme.

Introduction

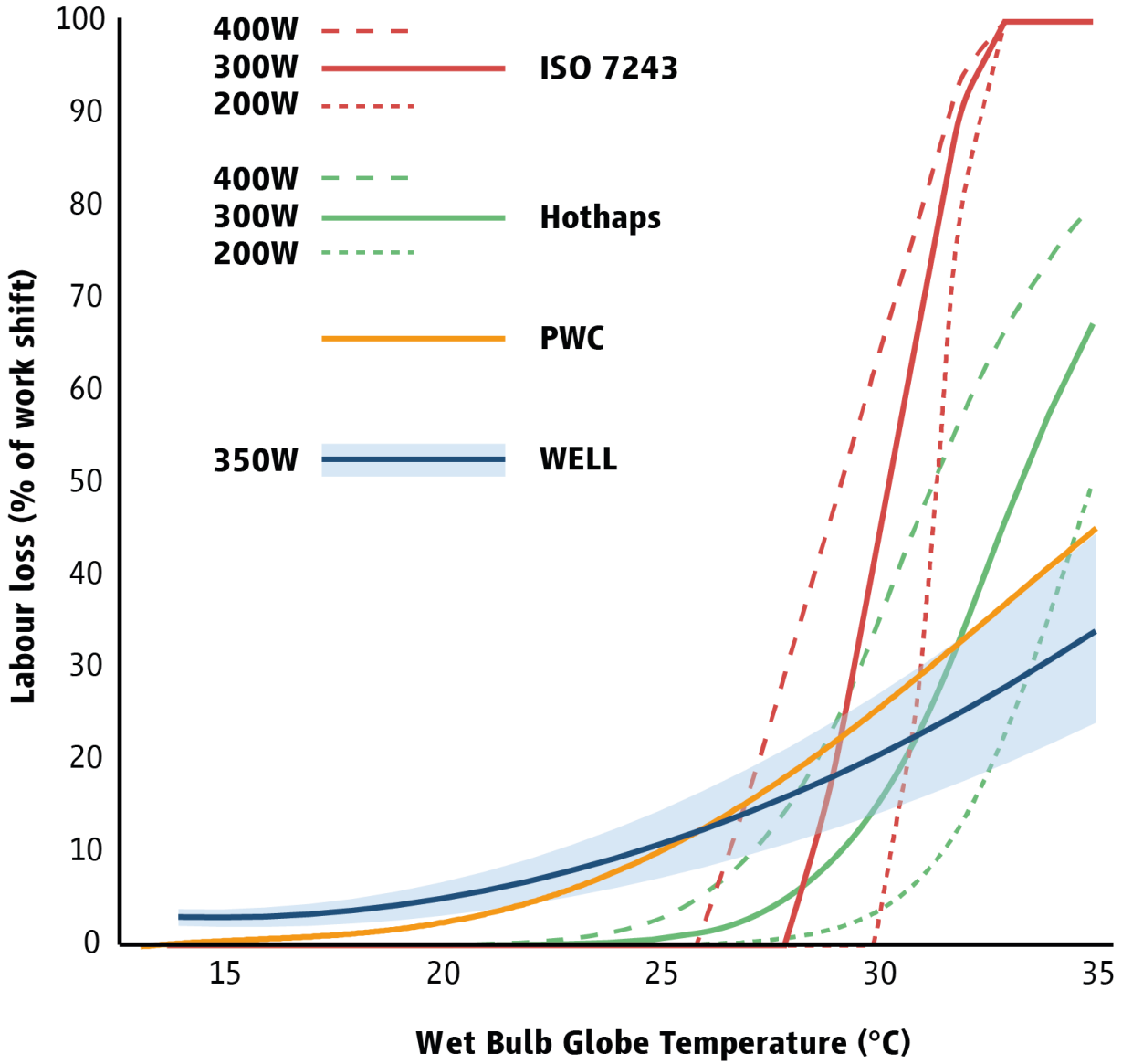
Nearly a third of the world's population is regularly exposed to climate conditions [illegible] exceed human thermoregulatory capacity, leading to major increases in morbidity and mortality.[1] Even if aggressive mitigation measures were to be adopted, estimates suggest that half of the world's population will be exposed to such conditions by 2100,[2] and several studies[3–5] report that by escalating occupational heat strain will directly threaten workers' health, with corresponding negative effects on productivity, poverty, and socioeconomic inequality. Occupational heat strain refers to the physiological effect of environmental heat stress on the body and it has a major impact on the ability of workers to live healthy and productive lives; nearly 1 million work-life years are projected to be lost by 2030 due to occupational heat stroke fatalities, with 70 million work-life years lost because of reduced labour productivity.[6,7] Warning systems for extreme weather events have been piloted in some countries, but they are designed for the general

Flouris et al., 2018, Lancet Plan Health

Analyses using existing models estimating labour productivity

- Current EU wide annual damages are **830 billion €** and will increase by a factor of five to **4 trillion €** by 2060 if no mitigation/adaptation action

Productivity losses are more widespread than we thought



Ioannou et al., under review

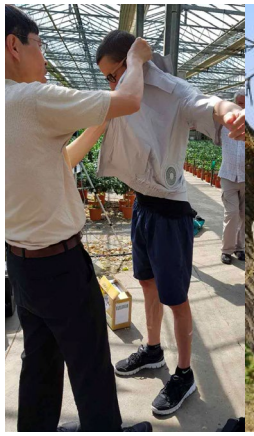
Mitigation strategies tested in HEAT-SHIELD

work-rest ratios

hydration

mechanization

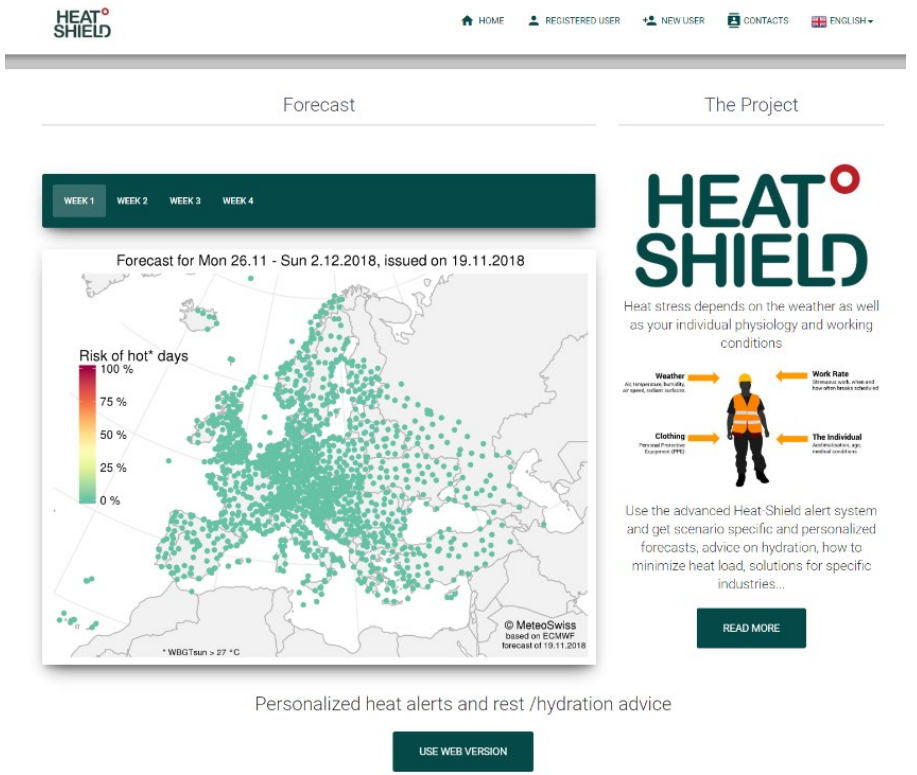
clothing

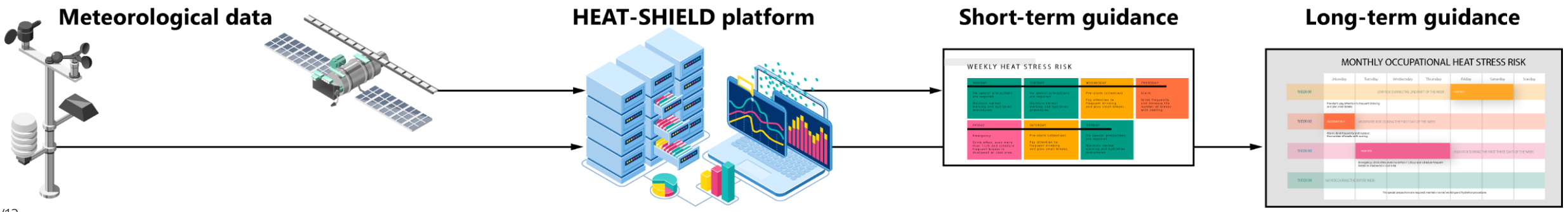


- Personalized warning system

HEAT-SHIELD early warning system – www.heat-shield.eu

- The HEAT-SHIELD platform can effectively protect from climate-related shocks, providing guidance to workers and employers early in advance





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