

# HEAT-SHIELD Deliverable 5.1:

## Report on existing European heat-health warning systems



Ana Casanueva<sup>1</sup>, Annkatrin Burgstall<sup>1</sup>, Sven Kotlarski<sup>1</sup>, Alessandro Messeri<sup>2</sup>, Marco Morabito<sup>2</sup>, Andreas Flouris<sup>3</sup>, Lars Nybo<sup>4</sup>, Christoph Spirig<sup>1</sup> and Cornelia Schwierz<sup>1</sup>

<sup>1</sup>Federal Office of Meteorology and Climatology MeteoSwiss, Zurich, Switzerland.

<sup>2</sup>University of Florence, Florence, Italy.

<sup>3</sup>FAME Laboratory, Department of Exercise Science, University of Thessaly.

<sup>4</sup>Department of Nutrition and Exercise Sciences, University of Copenhagen, Denmark.

The HEAT-SHIELD project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement No 668786.

## Summary

The ability to provide early warning of extreme heat events is of major importance for preventing fatal (mortal) outcomes as well as allowing communities to prepare and plan how to mitigate negative impact on humans. Existing European heat-health warning systems (HHWS) and associated action plans are mainly focused on preventing death during extreme heat events with warning categories determined from epidemiological studies linking mortality data to either air temperature or thermal indices (based on the four meteorological variables influencing heat stress: air temperature, humidity, wind speed, and solar radiation). While such systems are of importance for protection of vulnerable groups (with elderly dominating the mortality statistics), it is also clear that human health and occupational productivity are affected at much lower temperatures and typical prevention strategies/advising such as “avoid physical activity” and “stay indoors” are incompatible with maintained productivity. This report provides an overview of existing systems with main focus on the meteorological approach. But beyond pure meteorological factors it is clear that multi-sectorial approaches are needed in order to address climate change impacts on human heat exposure, including sociological (e.g. vulnerability of target groups to heat), physiological (e.g. human response to certain conditions), biometeorological (e.g. acclimatization ability to heat) and economic (e.g. costs and losses due to heat) factors. All these elements are required for the development and dissemination of short- and long-term heat-health planning in order to provide usable and tailored information to protect people against heat. Those plans are part of modern climate services, which aim to help individuals and organizations to make climate-smart decisions. At an international level, the improvement and development of HHWS is among the priorities of the World Meteorological Organization (WMO) and the World Health Organization (WHO). The present deliverable constitutes a state-of-the-art review of European heat-health warning systems and heat-health action plans (HHAPs) and aims to pave the way for future heat-health warning systems, such as the one currently under development in the HEAT-SHIELD project (Morabito et al. 2019).

HHWS typically rely on the establishment of certain thresholds of human-health tolerance to extreme weather. A HHWS is the weather-based alert component of a wider HHAP (Koppe et al. 2004). HHAPs usually link to national weather services and health authorities, and their purpose is to define timely, concrete and useful intervention strategies for specific risk levels. Some of the common advices are given at an individual level, e.g. to stay out of the heat, drink water, cool yourself down and keep the environment cool (PHE, 2018), or at a community level, e.g. to develop educational campaigns, set-up dedicated telephone services, increase media announcements, contact the health and fire departments and social services to assist people with limited resources, use a registry of vulnerable people and distribute fans (Kovats and Ebi, 2006).

The methodological approach followed in the present report consists of **1)** a review of existing literature on warning systems, **2)** a web-search over the websites of National Meteorological and Hydrological Services (NMHSs), conducted between January and May 2019 and **3)** a questionnaire distributed to selected NMHSs. The Web of Science database was searched using the terms “heat”, “warning system” and “health”, resulting in the retrieval of 176 papers. The web search consisted of a screening of NMHSs web sites and gathering of WMO and WHO reports. Only documents and publications in English, Spanish and German were considered. Additionally, questionnaires were sent personally to contacts at NMHSs in order to add expert knowledge. These questionnaires consisted of four parts: the weather forecast system (e.g. type of forecast system, temporal and spatial resolution), the heat-health warning system itself (e.g. which variable and thresholds trigger the warnings), action plans and intervention strategies (e.g. actions taken at specific warning levels) and the communication

and dissemination of the warnings (e.g. means of notification of warnings to users and stakeholders). In total, we gathered information from 16 European countries.

The existing HHWS in Europe deal with heat warnings by very diverse approaches. They use different variables and thresholds to trigger the warnings. The meteorological variables that trigger the warnings should present a clear link with the impact under consideration and should be chosen depending on the purpose and target of the warnings (Burgstall et al. 2019). The majority of the systems are based on daily mean or maximum temperature, only a few systems consider other relevant variables, such as minimum temperature or humidity. The intervention strategies implemented against heat waves are similar in the considered countries. There are, however, not many studies evaluating the effectiveness of such actions. Setting long-term planning actions as well as pre-alert levels might prevent and reduce damages due to heat. Finally, education and communication are key elements of the success of a warning system.

The diversity of European warning systems makes it difficult to warn on European scales, which might be of interest for some stakeholders. The HEAT-SHIELD platform is a good example of a European-wide and user-tailored warning system with a specific objective, namely, to protect workers' health and productivity (Morabito et al. 2019).

Further overview and detailed descriptions of the existing heat-health warning systems is provided in the below paper (see full report attached to this summary) published as a peer-review article in *Int. J. Env. Research and Public Health* **2019** - special issue on Climate Services, Weather Forecasts and Prevention of Human Thermal Stress)

Casanueva A., Burgstall A., Kotlarski S., Messeri A., Morabito, Flouris A., Nybo L., Spirig Ch. and C. Schwierz, Heat warnings in Europe: A review of existing systems, *Int. J. Env. Research and Public Health* **2019**, 16, 2657.

## References

Burgstall, A.; Casanueva, A.; Kotlarski, S.; Schwierz, C. Heat warnings in Switzerland: Reassessing the choice of the current heat stress index. *Int. J. Env. Research and Public Health* **2019**, 16, 2684.

Koppe, C.; Kovats, S.; Jendritzky, G.; Menne, B. Heat waves: risks and responses, No. 2. World Health Organisation, Copenhagen Hrsg., *Health and Global Environmental Change Series*, **2004**.

Kovats, R.S.; Ebi, K.L. Heatwaves and public health in Europe. *Europ. J. Pub. Health* **2006**, 16: 592–599.

Morabito, M.; Messeri, A.; Casanueva, A.; Crisci, A.; Kotlarski, S.; Orlandini, S.; Schwierz, C.; Spirig, C.; Nybo, L. The HEAT-SHIELD website platform: occupational heat warning system for the entire Europe. *Int. J. Env. Research and Public Health* **2019**, in review.

PHE (Public Health England), 2018. Heatwave plan for England – protecting health and reducing harm from severe heat and heatwaves. PHE publications gateway number: 2015049.