Online Supplement for

Indicators to assess physiological heat strain – Part 2: Delphi exercise

Leonidas G. Ioannou[1,2], Petros C. Dinas[1], Sean R. Notley[3], Flora Gofa[4], George A. Gourzoulidis[5], Matt Brearley[6,7], Yoram Epstein[8], George Havenith[9], Michael N. Sawka[10], Peter Bröde[11], Igor B. Mekjavic[12], Glen P. Kenny[3,13], Thomas E. Bernard[14], Lars Nybo[2], Andreas D. Flouris[1,3]*

[1]FAME Laboratory, Department of Physical Education and Sport Science, University of Thessaly, Trikala, Greece.
[2]Department of Nutrition, Exercise and Sports, August Krogh Building, University of Copenhagen, Denmark.
[3]Human and Environmental Physiology Research Unit, Faculty of Health Sciences, University of Ottawa, Ontario, Canada.
[4]Hellenic National Meteorological Service, Athens, Greece.
[5]Hellenic Ministry of Labour and Social Affairs, Athens, Greece.
[6]National Critical Care and Trauma Response Centre, Darwin, NT, Australia.
[7]Thermal Hyperformance, Pty Ltd, Takura, QLD, Australia.
[8]Heller Institute of Medical Research, Sheba Medical Center, Ramat Gan and the Sackler Faculty of Medicine, Tel Aviv University, Israel.
[9]Environmental Ergonomics Research Centre, Loughborough Design School, Loughborough University, Loughborough, United Kingdom.
[10]School of Biological Sciences, Georgia Institute of Technology, Atlanta, GA, USA.
[11]Department of Immunology, Leibniz Research Centre for Working Environment and Human Factors (IfADo), Dortmund, Germany.
[12]Department of Automation, Biocybernetics and Robotics, Jozef Stefan Institute, Ljubljana, Slovenia.
[13]Clinical Epidemiology Program, Ottawa Hospital Research Institute, Ottawa, Canada.
[14]College of Public Health, University of South Florida, 13201 Bruce B Downs Boulevard, Tampa, FL 33612, USA.

*Correspondence to: andreasflouris@gmail.com

DETAILED INFORMATION ON THE CRITERIA USED IN THE DELPHI EXERCISE

During the 1st iteration of the Delphi exercise, we asked our group of experts to score 12 criteria in the survey for their importance when considering adopting a thermal stress indicator (TSI) to protect individuals who work in the heat (criteria #1-12 below). Experts were informed that they could distribute a total of 100 points across all 12 criteria. In the same iteration, we also asked them to list any additional criteria that had not been considered in the survey. The experts added the need for a TSI to reflect the level of dehydration (criterion #13 below) as well as higher thresholds (>39°C) for mean body temperature (criteria #14-17 below). During the 2nd iteration, a revised version of the survey with all 17 criteria was sent to the same experts accompanied with the score (mean±sd) of criteria #1-12 from the 1st iteration. Experts were informed that they could distribute a total of 100 points across all 17 criteria and were encouraged to consider their answers in the 1st iteration in light of the general group responses, a process that facilitates converging towards consensus.[1-4] The 17 criteria used in the Delphi exercise are listed below. As in the main text of the article, they are coloured to indicate the three occupational health-and-safety pillars: contribution to improving occupational health (green), mitigation of worker physiological strain (blue), and cost-effectiveness (red).

Criterion	Description
1	Relationship (Pearson's correlation coefficient) with core temperature. This item describes the magnitude of the relationship between a TSI and core temperature measured using telemetric pills. Specifically, this item examines if workers' core temperature increases / decreases when the associated value of a TSI increases /decreases.
2	Relationship (Pearson's correlation coefficient) with mean skin temperature. This item describes the magnitude of the relationship between a TSI and mean skin temperature from four sites (chest, arm, thigh, and leg). Specifically, this item examines if workers' mean skin temperature increases / decreases when the associated value of a TSI increases /decreases.
3	Relationship (Pearson's correlation coefficient) with mean body temperature. This item describes the magnitude of the relationship between a TSI and mean body temperature (= $0.65 \times T_{core} + 0.35 \times T_{sk}$). Specifically, this item examines if workers' mean body temperature increases / decreases when the associated value of a TSI increases /decreases.
4	Relationship (Pearson's correlation coefficient) with heart rate. This item describes the magnitude of the relationship between a TSI and heart rate. Specifically, this item examines if workers' heart rate increases / decreases when the associated value of a TSI increases /decreases.
5	Diagnostic capacity to detect the proportion of workers with increased (>36.7°C) mean body temperature by evaluating the area under the ROC curve. The Area Under the ROC curve ranges from zero to one and evaluates the capacity of a TSI to diagnose when workers are likely to have >36.7°C mean body temperature.
6	Sensitivity (ability to detect positive cases) to detect the proportion of workers with increased (>36.7°C) mean body temperature. This item examines the sensitivity (also called the true positive rate) of a TSI to assess the proportion of workers with high mean body temperature (>36.7°C) who are correctly identified as having high mean body temperature.
7	Specificity (ability to detect negative cases) to detect the proportion of workers with normal (≤36.7°C) mean body temperature. This item examines the specificity (also called the true negative rate) of a TSI to assess the proportion of workers with normal mean body temperature (<36.7°C) who are correctly identified as not having high mean body temperature.
8	Showing increased probability (i.e., risk ratio) to be at a high category (e.g., "hot" compared to "neutral") when a worker has increased (>36.7°C) mean body temperature. This item describes the capacity of a TSI to diagnose the increase in risk for having high mean body temperature when being exposed to environmental parameters characterized by a higher-level heat stress category. For instance, a worker has four times higher risk for having increased mean body temperature when being exposed to a heat stress category characterized as "high heat stress" compared to the thermoneutral category.
9	Having categories indicating the level of heat stress experienced by workers. For instance, a Wet-Bulb Globe Temperature value of 30°C indicates that workers exposed to such an environment will experience high heat stress. TSIs without heat stress categories are scored with "0" in this item.
10	Using its heat stress categories to provide recommendations for occupational safety and health (water consumption, breaks, work intensity, etc.). This item examines if there are any published health-related recommendations for the categories identified for a TSI. TSIs without such recommendations are scored with "0" in this item.
11	Practicality and cost-effectiveness during the 1st year of use. Cost effectiveness is calculated as the ratio of cost and effectiveness. The cost calculation considers three parameters: 1. Cost of equipment (TSIs assessing >1 environmental parameter are more expensive to be computed; Air temperature + Relative humidity = 73.9 € / 83.5 US$; Wind Speed = 46.1 € / 52.1 US$; and Solar Radiation = 144.8 € / 163.7 US$). These costs are based on an extensive internet search in relevant providers of scientific, commercial, and industrial equipment (the average cost for buying the equipment was considered). 2.Time required for measuring the environmental parameters of a TSI (2 min for each environmental parameter). 3. Training cost for health and safety instructors (we assume a cost of ~20 € / 22.6 US$ for each environmental parameter). Effectiveness is calculated as a utility value, being the sum of criteria #1-10 and #13-17 of this Delphi exercise.
12	Practicality and cost-effectiveness in a 10-year period. As for criterion #11, cost effectiveness is calculated as the ratio of cost and effectiveness. The calculation of cost for each year is as described in criterion #11, with the exception that the cost of equipment is not considered for years 2 to 10. The costs across all years are summed to calculate the total 10-year cost. Effectiveness is calculated as described in criterion #11.

13	Relationship (Pearson's correlation coefficient) with level of dehydration. This item describes the magnitude of the relationship between a TSI and a measure of dehydration (urine specific gravity, total water loss, etc.). Specifically, this item examines if workers' dehydration increases / decreases when the associated value of a TSI increases /decreases.
14	Diagnostic capacity to detect the proportion of workers with extreme (>39°C) mean body temperature based on the Area Under the ROC Curve. The Area Under the ROC curve ranges from zero to one and evaluates the capacity of a TSI to diagnose when workers are likely to have >39°C mean body temperature.
15	Sensitivity (ability to detect positive cases) to detect the proportion of workers with extreme (>39°C) mean body temperature. Sensitivity (ability to detect positive cases) to detect when a worker has extreme (>39°C) mean body temperature. This item examines the sensitivity (also called the true positive rate) of a TSI to assess the proportion of workers with extreme (>39°C) mean body temperature who are correctly identified as having extreme mean body temperature.
16	Specificity (ability to detect negative cases) to detect the proportion of workers without extreme mean body temperature (≤39°C). This item examines the specificity (also called the true negative rate) of a TSI to assess the proportion of workers who do not have extreme mean body temperature (≤39°C) who are correctly identified as not having extreme mean body temperature.
17	Showing increased probability to be at a high category (e.g., "hot" compared to "neutral") when a worker has extreme mean body temperature (>39°C). This item describes the capacity of a TSI to diagnose the increase in risk for having extreme mean body temperature when being exposed to environmental parameters characterized by a higher-level heat stress category. For instance, a worker has four times higher risk for having extreme mean body temperature (>39°C) when being exposed to a heat stress category characterized as "high heat stress" compared to the thermoneutral category.

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