This work is licensed under a Creative Commons Attribution 4.0 International License.

Scand J Work Environ Health – online first.

Occupational heat stress and productivity loss: methodological considerations and implications for worker protection. Response to: Tantipanjaporn et al. Effect of occupation-related heat stress exposure on productivity among sugarcane workers in Thailand

The recent study by Tantipanjaporn et al (1) provides valuable field-based evidence on the association between occupational heat stress exposure and productivity among sugarcane workers in Thailand. While the findings contribute to understanding the occupational consequences of heat exposure, several methodological and interpretive considerations warrant further discussion.

The study examined the association between occupational heat stress exposure and productivity among 287 sugarcane workers in Thailand. It provides valuable field-based evidence of the challenges agricultural workers in tropical environments face, particularly as rising temperatures threaten both worker health and economic productivity. I agree that understanding the relationship between heat exposure and work performance is important for occupational health research and policy. However, several methodological and interpretive considerations deserve further attention before the findings can be translated into preventive strategies.

To begin with, the exposure–response relationship contains considerable uncertainty. The authors report that each 1°C rise in full-shift time-weighted average effective wet bulb globe temperature (WBGT) corresponds to 8.59 fewer sugarcane stalks harvested per hour (95% confidence interval -16.19– -0.99) (1). Although this points to a clear drop in output under higher heat, that wide confidence interval leaves the true size of the effect imprecise. Because the study is cross-sectional, it also cannot establish the sequence of events or fully separate heat exposure from other variables driving daily output. Testing for nonlinear trends across different heat thresholds would give a much clearer picture of where performance actually breaks down.

In addition, observational data makes it tricky to separate independent confounders from the body's direct reactions to heat. Break duration, fluid intake, workload, and heat-related symptoms may influence work performance. However, some of these factors may also represent responses to heat exposure rather than independent confounders. Adjusting for variables that potentially lie along the causal pathway could alter the estimated association between heat exposure and productivity. Consequently, the interpretation of adjusted estimates depends on the underlying causal assumptions and the temporal relationships among exposure, behavioral adaptations, physiological responses and work output.

Finally, a drop in productivity should not be interpreted as a direct indicator of occupational heat strain or worker safety. Reduced work output may represent an early physiological response to excessive heat exposure, but it may also reflect protective behavioral adaptations, such as reducing work intensity or taking additional recovery periods. Conversely, workers may maintain productivity despite experiencing symptoms of heat-related illness. In a related investigation among Thai sugarcane workers, van Tongeren et al (2) reported that 98% of participants experienced at least one heat-related symptom, while 74% reported at least one symptom classified as severe. Although these findings cannot establish a direct relationship between symptoms and productivity, they emphasize the importance of evaluating worker health alongside occupational performance.

These considerations are particularly relevant to physically demanding outdoor occupations in tropical countries, including agriculture and construction, where workers experience prolonged heat exposure, variable workloads, and limited opportunities for recovery. Environmental heat assessment using WBGT remains essential, but it should be complemented by systematic recognition of heat-related symptoms, evaluation of work–rest practices, access to adequate hydration and clear procedures for responding to suspected heat-related illness. Importantly, preventive measures should not be evaluated solely according to their ability to preserve productivity as reduced work intensity and additional rest may constitute necessary protective responses.

The findings of Tantipanjaporn et al (1) make an important contribution to understanding the occupational consequences of heat exposure. Nevertheless, greater attention to causal interpretation, individual physiological responses and the distinction between productivity loss and protective work adaptations would strengthen the implications for occupational health practice. Future longitudinal and intervention studies integrating repeated environmental measurements, physiological indicators, symptom surveillance and

detailed work–rest observations could provide more robust evidence to guide prevention. Ultimately, the effectiveness of occupational heat stress management should be assessed not only by maintaining work output but, more importantly by preventing heat-related illness and safeguarding worker health.

References

1. Tantipanjaporn T, Povey A, Shiels HA, Gittins M, van Tongeren M. Effect of occupation-related heat stress exposure on productivity among sugarcane workers in Thailand. Scand J Work Environ Health 2026. [E-pub ahead of print]. https://doi.org/10.5271/sjweh.4336

2. van Tongeren M, Tantipanjaporn T, Povey A, Shiels HA, Gittins M. Occupational related heat stress exposure and heat-related symptoms among sugarcane workers in Thailand. Int Arch Occup Environ Health. 2026;99(5):29. https://doi.org/10.1007/s00420-026-02216-4.

Dayana Hazwani Mohd Suadi Nata, PhD [1]

[1] Center for Toxicology and Health Risk Studies (CORE), Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Malaysia.

Correspondence to: Dayana Hazwani Mohd Suadi Nata, PhD, Center for Toxicology and Health Risk Studies (CORE), Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Faculty of Health Sciences UKM, 50300, Kuala Lumpur, Malaysia. [E-mail: dayanahazwani@ukm.edu.my]