Editorial
Volume 24, issue 2, pp. 1-8
Opens July 1st, closes December 31st, 2026
ISSN: 1659-4436

Using Science to Inform Heat Mitigation: From Organizational Planning to Individual Action

Yuri Hosokawa, PhD, ATC, FACSM

Published: 2026-08-12

Doi: https://doi.org/10.15517/tvs7ce51

How to cite this paper?

Hosokawa, Y (2026). Using Science to Inform Heat Mitigation: From Organizational Planning to Individual Action. *Pensar en Movimiento: Revista de Ciencias del Ejercicio y la Salud,* 24(2), e11558. https://doi.org/10.15517/tvs7ce51

Using Science to Inform Heat Mitigation: From Organizational Planning to Individual Action

El uso de la ciencia para orientar la mitigación del calor: de la planificación organizativa a la acción individual

O uso da ciência para orientar a mitigação do calor: do planejamento organizacional à ação individual

Yuri Hosokawa, PhD, ATC, FACSM [1]

Abstract: As rising global temperatures increase heat-related risks, effective heat mitigation requires coordinated actions at both organizational and individual levels. This editorial highlights three recent studies that provide evidence-based approaches to protecting physically active individuals in hot environments. Organizational strategies include event planning, medical preparedness, stakeholder coordination, and emergency response systems for mass sporting events. Individual-level tools can improve decision-making by integrating environmental conditions, activity characteristics, and personal factors to guide hydration, cooling, clothing, and activity modifications. Evidence also suggests that water-resistant sunscreen may slightly elevate core body temperature during exercise in the heat. Together, these studies demonstrate that comprehensive, multi-level strategies are essential for reducing heat-related illness and translating scientific evidence into routine practice.

Keywords: body temperature, hydration, health.

Resumen: Ante el aumento de las temperaturas globales, prevenir las enfermedades relacionadas con el calor es una prioridad para la salud pública y el deporte. Este editorial destaca la necesidad de combinar la preparación organizativa con estrategias individuales basadas en evidencia. Entre las medidas organizativas se incluyen la planificación de eventos, la preparación médica, la coordinación entre actores y los protocolos de emergencia. A nivel individual, se propone una herramienta que integra factores ambientales y personales para orientar decisiones sobre hidratación, vestimenta, descanso y enfriamiento. Además, se analiza la posible influencia de protectores solares resistentes al agua sobre la termorregulación. En conjunto, los estudios demuestran que la protección eficaz frente al calor requiere acciones coordinadas y multidimensionales.

[1] Faculty of Sport Sciences, Waseda University, Saitama, Japan. e-mail: yurihosokawa@waseda.jp

Palabras clave: temperatura del cuerpo, hidratación, salud.

Resumo: Com o aumento das temperaturas globais, a prevenção de doenças relacionadas ao calor tornou-se uma prioridade para a saúde pública e o esporte. Este editorial destaca a importância de estratégias integradas que combinem preparação organizacional e ações individuais baseadas em evidências. Entre as medidas organizacionais estão o planejamento de eventos, a preparação médica, a coordenação entre diferentes atores e os sistemas de resposta a emergências. No nível individual, uma ferramenta de avaliação do estresse térmico auxilia decisões sobre hidratação, vestuário, pausas e resfriamento. Além disso, discute-se o impacto de protetores solares resistentes à água na termorregulação. Em conjunto, os estudos demonstram que a proteção eficaz contra o calor depende de ações coordenadas e multidimensionais.

Palavras-chave: temperatura corporal, hidratação, saúde.

As the infamous quote by the United Nations Secretary-General António Guterres goes, the era of global warming has ended; the era of global boiling has arrived (*Secretary-General's Press Conference on Climate | Secretary-General*, 2023). The issue of heat in the context of human health is no longer a localized topic; no nation on earth is immune to this threat, and sport has been one of the primary industries that have adopted measures to find their way to sustainability through activity and behavioral modifications (Esh et al., 2026a; Périard et al., 2021). As we continue to host major sporting events in the summer months (Esh et al., 2026b; Mason et al., 2024), the scientific community has developed guidelines to ensure the health and safety of athletes (Casa et al., 2015; Racinais et al., 2023; Roberts et al., 2023).

An effective heat mitigation strategy must include actions from both the organizational (i.e., environmental) sector and athletes themselves (Racinais et al., 2023). Having one or the other is insufficient, as most heat mitigation actions require direct contributions from both parties to ensure the strategies are implemented effectively. Three articles from the *Journal of Science and Medicine in Sport,* translated into Spanish, present recent evidence to help readers understand the factors that influence our resilience to heat during sports and physical activities. Two are available in the current issue of *Pensar en Movimiento* (Vol. 24, No. 2) (Mason et al., 2024; Tartarini et al., 2025), while the third one is available from the University of Costa Rica Kérwá repository (www.kerwa.ucr.ac.cr) (Garzón-Mosquera & Aragón Vargas, 2026).

From an organizational standpoint, Mason et al. (2024) conducted a systematic review to synthesize recommendations for future mass-gathering events in heat. While their study was motivated by the series of major sporting events (e.g., Rugby World Cup and the Brisbane 2032 Olympic and Paralympic Games) scheduled in Queensland, Australia, their findings provide a framework that is broadly applicable to sporting events in diverse geographical settings. Key themes included event planning, heat-mitigation strategies, medical personnel and resources, evidence-informed policy, education, and future research. Many of these themes align closely with broader principles of emergency preparedness in sport. The literature on emergency

preparedness in sport indeed emphasizes the need for collaborative effort among all stakeholders, including event organizers, medical staff inside and outside the event, and operational personnel such as security staff, police, and event administrators (Adams et al., 2018; Scarneo-Miller et al., 2024). Because exertional heat stroke requires immediate recognition and treatment at the point of collapse to optimize survival and neurological outcomes (Filep et al., 2020; Hosokawa et al., 2021), effective coordination among stakeholders becomes even more critical. This mirrors the multidisciplinary planning routinely implemented for sudden cardiac arrest preparedness at sporting events (Pelto & Drezner, 2020).

Not all physically active populations participate in organized competitions or mass-gathering events; many engage in physical activity for recreation, health, or lifestyle purposes. Nonetheless, heat-related illnesses are not confined to competitive settings and pose a similar threat to these individuals' health and well-being. A widely accepted approach to quantifying environmental heat stress is the use of thermal indices such as the wet-bulb globe temperature (WBGT) and the Universal Thermal Climate Index (UTCI) (Hosokawa et al., 2019). Although these indices are widely used in sport, occupational, and military settings, current activity modification guidelines may not adequately account for differences in activity type or exercise intensity (Hosokawa et al., 2019; Racinais et al., 2023). Because human heat balance is determined by both environmental heat stress and metabolic heat production, Tartarini et al. (2025) developed a Heat Stress Index–based decision-support tool that incorporates activity-specific metabolic rates, clothing characteristics, self-generated air movement, and local weather data obtained from the nearest weather station. Rather than simply quantifying heat risk, the tool also provides graded recommendations to mitigate heat strain through hydration, clothing modifications, work-to-rest adjustments, and body cooling strategies. Such individualized, context-specific guidance can support evidence-informed decision-making by organizations and individuals alike while promoting effective heat-risk mitigation behaviors, including cessation of activity when the risk is too high.

Garzón-Mosquera and Aragón Vargas (2026) shift the focus from environmental heat risk assessment to an individual-level heat mitigation strategy. They investigated the influence of water-resistant sunscreen on thermoregulation by potentially reducing the evaporative efficiency of sweat during a 1-hour bout of moderate-intensity exercise (50% VO_2peak) in heat (air temperature, 35°C; relative humidity, 55%). The International Olympic Committee Medical and Scientific Commission recommends using water-based sunscreen to mitigate heat risk for athletes (Racinais et al., 2023). This study reinforces this recommendation by demonstrating that water-resistant sunscreen can result in a small but statistically significant increase (0.21°C) in internal body temperature after a 1-hour exercise bout, most likely due to reduced evaporative efficiency of sweat. Although the magnitude of this increase was modest under controlled laboratory conditions, even small elevations in thermal strain may become more relevant during prolonged or higher-intensity exercise in the heat, where thermoregulatory demands are greater. While there remains a paucity of data on the effects of various sunscreen formulations on thermoregulation during exercise, considering these formulations will help athletes and support

staff make more informed decisions when balancing protection against ultraviolet radiation with the preservation of thermoregulatory function.

Collectively, these studies reinforce a fundamental principle of heat-risk management: no single intervention is sufficient to safeguard physically active individuals in the heat. Effective heat mitigation requires coordinated actions across multiple levels, combining organizational preparedness with individual behavioral strategies. Event organizers, governing bodies, employers, and medical personnel play essential roles in creating environments that minimize heat risk through evidence-informed policies, emergency action plans, and appropriate resource allocation. Equally important, athletes and other physically active individuals must actively engage in behaviors that reduce physiological strain, including appropriate hydration, heat acclimatization, clothing selection, sun protection, and body cooling. Neither organizational measures nor individual actions alone can fully mitigate heat-related risk; rather, meaningful protection is achieved only when both are implemented in a complementary and coordinated manner. As participation in physical activity continues to expand across diverse settings and climates, future efforts should focus not only on developing new heat-mitigation strategies but also on improving their implementation, ensuring that evidence-based recommendations are translated into routine practice by all stakeholders.

References

Adams, W. M., Hosokawa, Y., Troyanos, C., & Jardine, J. F. (2018). Organization and Execution of On-site Health Care During a Mass Participation Event. *Athletic Training and Sports Health Care, 10*(3), 101–104. https://doi.org/10.3928/19425864-20180329-02

Casa, D. J., DeMartini, J. K., Bergeron, M. F., Csillan, D., Eichner, E. R., Lopez, R. M., Ferrara, M. S., Miller, K. C., O'Connor, F., Sawka, M. N., & Yeargin, S. W. (2015). National Athletic Trainers' Association position statement: Exertional heat illnesses. *Journal of Athletic Training, 50*(9), 986–1000. https://doi.org/10.4085/1062-6050-50.9.07

Esh, C. J., Carter, S., Bougault, V., Girard, O., van Rensburg, D. C. J., Chrismas, B. C. R., Meyer, T., & Taylor, L. (2026a). One Step Further: Integrating Evidence-Based Guidelines into Practice to Address Environmental Challenges at the Men's 2026 FIFA World Cup. *Sports Medicine, 56*(6), 1363–1380. https://doi.org/10.1007/s40279-026-02415-6

Esh, C. J., Carter, S., Bougault, V., Girard, O., van Rensburg, D. C. J., Chrismas, B. C. R., Meyer, T., & Taylor, L. (2026b). The 2026 Men's FIFA Football World Cup: Evidence-Based Guidelines to Protect Player Health and Performance from Environmental Challenges. *Sports Medicine, 56*(6), 1337–1361. https://doi.org/10.1007/s40279-026-02398-4

Filep, E. M., Murata, Y., Endres, B. D., Kim, G., Stearns, R. L., & Casa, D. J. (2020). Exertional Heat Stroke, Modality Cooling Rate, and Survival Outcomes: A Systematic Review. *Medicina, 56*(11). https://doi.org/10.3390/medicina56110589

Garzón-Mosquera, J. C., & Aragón Vargas, L. F. (2026). Water-resistant sunscreen use may increase core body temperature during prolonged exercise in the heat. *Journal of Science and Medicine in Sport*, S1440-2440(26), 1-8. https://doi.org/10.1016/j.jsams.2026.04.012

Hosokawa, Y., Casa, D. J., Trtanj, J. M., Belval, L. N., Deuster, P. A., Giltz, S. M., Grundstein, A. J., Hawkins, M. D., Huggins, R. A., Jacklitsch, B., Jardine, J. F., Jones, H., Kazman, J. B., Reynolds, M. E., Stearns, R. L., Vanos, J. K., Williams, A. L., & Williams, W. J. (2019). Activity modification in heat: Critical assessment of guidelines across athletic, occupational, and military settings in the USA. *International Journal of Biometeorology, 63*(3), 405–427. https://doi.org/10.1007/s00484-019-01673-6

Hosokawa, Y., Racinais, S., Akama, T., Zideman, D., Budgett, R., Casa, D. J., Bermon, S., Grundstein, A. J., Pitsiladis, Y. P., Schobersberger, W., & Yamasawa, F. (2021). Prehospital management of exertional heat stroke at sports competitions: International Olympic Committee Adverse Weather Impact Expert Working Group for the Olympic Games Tokyo 2020. *British Journal of Sports Medicine, 55*(24), 1405–1410. https://doi.org/10.1136/bjsports-2020-103854

Mason, H. M., King, J. C., Peden, A. E., Leicht, A. S., & Franklin, R. C. (2024). The impact of extreme heat on mass-gathering sporting events: Implications for Australia and other countries. *Journal of Science and Medicine in Sport, 27*(8), 515–524. https://doi.org/10.1016/j.jsams.2024.04.015

Pelto, H. F., & Drezner, J. A. (2020). Design and Implementation of an Emergency Action Plan for Sudden Cardiac Arrest in Sport. *Journal of Cardiovascular Translational Research, 13,* 331-338. https://doi.org/10.1007/s12265-020-09988-1

Périard, J. D., Eijsvogels, T. M. H., & Daanen, H. A. M. (2021). Exercise under heat stress: Thermoregulation, hydration, performance implications, and mitigation strategies. *Physiological Reviews, 101*(4), 1873–1979. https://doi.org/10.1152/physrev.00038.2020

Racinais, S., Hosokawa, Y., Akama, T., Bermon, S., Bigard, X., Casa, D. J., Grundstein, A., Jay, O., Massey, A., Migliorini, S., Mountjoy, M., Nikolic, N., Pitsiladis, Y. P., Schobersberger, W., Steinacker, J. M., Yamasawa, F., Zideman, D. A., Engebretsen, L., & Budgett, R. (2023). IOC consensus statement on recommendations and regulations for sport events in the heat. *British Journal of Sports Medicine, 57*(1), 8–25. https://doi.org/10.1136/bjsports-2022-105942

Roberts, W. O., Armstrong, L. E., Sawka, M. N., Yeargin, S. W., Heled, Y., & O'Connor, F. G. (2023). ACSM Expert Consensus Statement on Exertional Heat Illness: Recognition, Management, and Return to Activity. *Current Sports Medicine Reports, 22*(4), 134–149. https://doi.org/10.1249/JSR.0000000000001058

Scarneo-Miller, S. E., Hosokawa, Y., Drezner, J. A., Hirschhorn, R. M., Conway, D. P., Elkins, G. A., Hopper, M. N., & Strapp, E. J. (2024). National Athletic Trainers' Association Position Statement: Emergency Action Plan Development and Implementation in Sport. *Journal of Athletic Training, 59*(6), 570–583. https://doi.org/10.4085/1062-6050-0521.23

Secretary-General's press conference on climate | Secretary-General. (2023, July 27). https://www.un.org/sg/en/content/sg/press-events/2023-07-27/secretary-generals-press-conference-climate

Tartarini, F., Smallcombe, J. W., Lynch, G. P., Cross, T. J., Broderick, C., & Jay, O. (2025). The Sports Medicine Australia extreme heat risk and response guidelines and web tool. *Journal of Science and Medicine in Sport, 28*(9), 690–699. https://doi.org/10.1016/j.jsams.2025.03.006

Pensar en Movimiento

Realice su envío aquí

Consulte nuestras normas de publicación aquí

Indexada en:

SciELO · redalyc.org · DOAJ · Dialnet · latindex · LILACS · ERIH PLUS EUROPEAN REFERENCE INDEX FOR THE HUMANITIES AND SOCIAL SCIENCES

pensarenmovimiento.eefd@ucr.ac.cr

Revista Pensar en Movimiento

PensarMov