REST HUB
Environment Ready

Heat Management: Para-athletes

Para-athletes may be at greater risk of thermal strain in the heat and respond differently to common heat management strategies compared to able-bodied individuals. As such, it is particularly important to consider the interplay between 1) the nature of the disability and consequent impairments, 2) the characteristics of the sport and 3) other individual characteristics, to optimise performance.

Factors affecting heat strain

Nature & severity of the disability

Spinal cord injury: impaired sweating and blood flow responses below the lesion level, resulting in lower heat loss capacity in those with a high spinal cord injury, and differences in fluid intake requirements.

Cerebral palsy: greater metabolic heat production and fatigue for a given workload due to reduced movement efficiency, and potential differences in pace awareness and perception of effort.

Amputation: reduced surface area for heat loss where prosthetic liners or skin grafts are present, potential gait asymmetries and greater physical effort during ambulation leading to increased metabolic heat production (particularly for proximal or bilateral amputations), and localised thermal discomfort at prosthesis.

Vision impairment: impaired ability to monitor hydration status through urine colour, and those with albinism at heightened risk of sunburn which may in turn compromise sweat responsiveness.

Multiple sclerosis (within Les Autres classification): potential increase in heat sensitivity and fatigue during exercise in the heat, even with minor increases in core temperature.

Sport characteristics

Environment: outdoor environments are typically more thermally challenging than indoor due to higher ambient temperature and exposure to radiant heat.

Duration: longer exercise and extended passive heat exposure may lead to greater thermal strain.

Intensity: higher exercise intensity will lead to greater metabolic heat production; however, even passive heat exposure may increase thermal strain in Para-athletes with severely impaired heat loss mechanisms.

Clothing: light coloured clothing or wicking material may assist with convective and evaporative cooling from the skin, whereas certain protective clothing, uniform requirements or sitting in a wheelchair may be a hindrance for heat loss.

Individual characteristics

Fitness: athletes with higher fitness levels may generate greater metabolic heat than less trained counterparts. However, a higher fitness also enables lower cardiovascular strain for a given workload, thereby allowing greater blood flow to the skin for heat dissipation.

Body size: athletes with smaller mass or lower surface area-mass ratio (BSA:M) may experience a greater increase in core temperature for a given workload compared to larger individuals and those with a higher BSA:M.

Sex: in females, BSA:M and hormonal changes throughout the menstrual cycle may impact evaporative heat loss capacity when thermal load is high.

Thermal strain & para sport

The following figure demonstrates the general risk of thermal strain based on the para sport and the commonality of disabilities more prone to impaired heat loss within each sport.

While this alone cannot be used to determine individual risk, the information provides a general overview of sports with a potentially increased need to consider heat management in their preparations.

To develop individualised heat management plans, it is recommended that thermoregulatory testing be conducted pre-, during, and post-exercise in warm environments under guidance.

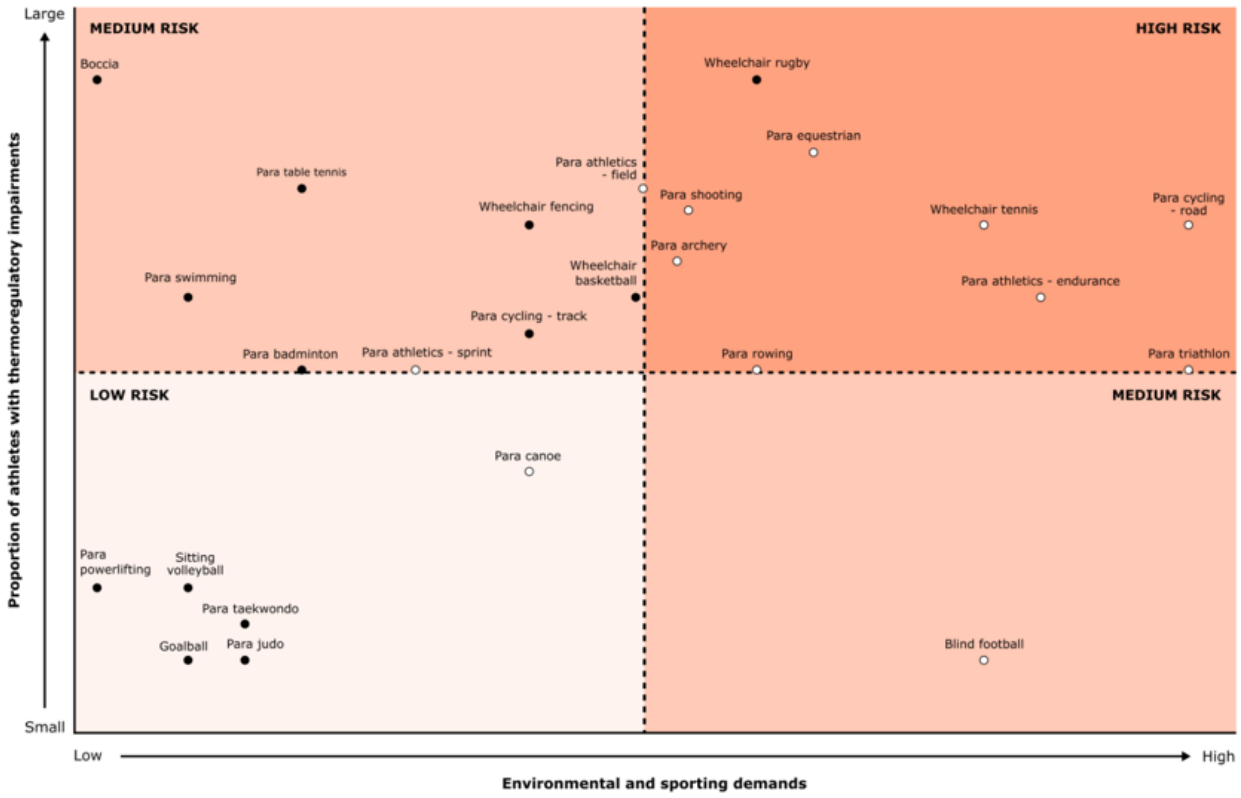

Figure 1. The general risk of thermal strain based on the sport and the commonality of disabilities more prone to impaired heat loss within each sport.

Alkemade P, Maloney P, Griggs K. To be published in Handbook of Applied Sports Science and Exercise in Disability Sports (2025). Adapted from original reference: Griggs K, Stephenson B, Price M, Goosey-Tolfrey V. Heat-related issues and practical applications for Paralympic athletes at Tokyo 2020. Temperature. 2020 Jan 2;7(1):37-57.

Heat management strategies

Three key heat management strategies are detailed below, with a sample of considerations when applying these strategies with Para-athletes. In most situations, a combination of strategies will ensure optimal preparation and performance during exercise in the heat.

Cooling Strategies

Can be applied externally or internally, and may be implemented pre-, during, or post-exercise, depending on the athlete's needs, sport constraints, and environmental conditions.

- When applying external cooling strategies, consideration should be given to Para-athletes with differences in local sensation arising from sensory impairments.
- External cooling strategies may be less effective if not considered in relation to body shape, as congenital disabilities, amputations, or muscular atrophy may negatively impact skin surface contact with the cooling medium (particularly cooling garments).
- Volume and timing of internal cooling strategies (e.g., slushie ingestion) should be thoroughly trialled. Athletes competing in a wheelchair or those with gastrointestinal issues may be particularly susceptible to gut discomfort, and those with a high SCI (above T6) may experience autonomic dysreflexia if distension of the bladder occurs.
- Disabilities that impair physical function may influence which cooling strategies are most practical and safe for use in-the-field.
- In most situations a combination of cooling strategies pre-, during, or post-exercise will be most beneficial to manage both physiological and perceptual thermal strain.

Heat Acclimation

Repeated exposure to hot/dry or hot/humid conditions to maximise physiological adaptations, thereby improving exercise performance and thermal comfort.

- An athlete's capacity to sweat is likely to be of key importance to the success of heat acclimation. For Para-athletes lacking a sweat response, heat acclimation will likely be ineffective at inducing heat adaptations. For these athletes, the use of cooling strategies is recommended to optimise performance capacity and thermal comfort.
- Provided there is some capacity to produce a sweat response, even if reduced or limited to certain skin surface regions, heat acclimation has the potential to be effective.
- For all athletes, the prescription of heat exposures should be carefully considered within the training block, as heat provides an additional load. This may be especially important for Para-athletes with a disability that makes them particularly susceptible to fatigue.
- Athletes physiological and perceptual responses should be monitored closely within heat exposures to ensure safety is maintained, particularly for those with disabilities associated with impaired thermoregulatory capacity.

Hydration

Assists with the maintenance of cardiovascular and heat regulation, perception of effort, mental function, and gut function during exercise in the heat.

- Inconvenient/inaccessibility of bathroom access may lead Para-athletes with impaired mobility to intentionally avoid adequate hydration. In these instances, the use of electrolytes and a well-planned rehydration strategy is vital.
- For those with impaired sweating, over-hydration may lead to hyponatremia, or autonomic dysreflexia in those with a high SCI (above T6) due to distension of the bladder.
- Determine sweat rate when competing in the heat to enable an individualised hydration plan.

Recommended Reading

Griggs K, Stephenson B, Price M, Goosey-Tolfrey V. Heat-related issues and practical applications for Paralympic athletes at Tokyo 2020. Temperature (Austin). 2019 Jun 27;7(1):37-57. doi: 10.1080/23328940.2019.1617030.

Price M. Preparation of paralympic athletes; Environmental concerns and heat acclimation. Front Physiol. 2016 Jan14;6:415. doi: 10.3389/fphys.2015.00415.

Pritchett K, Broad E, Scaramella J, Baumann S. Hydration and cooling strategies for paralympic athletes: Applied focus: challenges athletes may face at the upcoming Tokyo Paralympics. Curr Nutr Rep. 2020 Sep;9(3):137-146. doi: 0.1007/s13668-020-00317-1.