

motorcycles, or motorised carts equipped with minimal supplies and automatic defibrillators. If longer response times are anticipated, the information should be published in the pre-race education packets.

Transportation for well drop-outs should be arranged so those who cannot complete the event due to fatigue or minor injury or illness do not become ill due to exposure after their race participation has ceased. Medical support vehicles should not be used as transportation for well runners who are unable to finish the race.

6. **Public Authority Notification.** It is essential to coordinate with local hospitals, emergency medical vehicles, fire fighters, and police. They must be notified of the race date, start and completion times, course route and intersection closures, and anticipated casualties. If the proposed course involves traffic lanes or intersection closures, permission and traffic controls may need to be arranged with local police, and proper permits obtained. The telephone-accessed emergency notification system should be used by the race volunteers when available.
7. **Risk Management.** In the event of an adverse outcome, such as a death, a protocol should be in place for medical confidentiality, notification of the family, and public comment through the press. The Medical Director or designated representative and the Race President or chief administrator should act as spokespersons, and all other race personnel should refrain from discussing the case outside the immediate medical team. This protocol should be presented to all volunteers before race day and implemented when necessary.
8. **Supplies and Equipment.** See Appendix I.

2. ENVIRONMENTAL CONSIDERATIONS

The potential for heat and cold injuries is related to environmental conditions of temperature, relative humidity, direct sun exposure, wind speed, and altitude plus individual factors of conditioning level, acclimatisation to heat, running pace, fluid intake, and type of clothing worn.

1. **Race Day Selection.** When scheduling a new event, avoid temperature extremes by choosing an environmentally friendly time of the year and scheduling the start and finish during the coolest part of the day for spring, summer, and fall months; and during the warmer parts of the day during winter in the temperate latitudes. When advising an existing race, make every effort to move starting times to the early morning hours to give the elite

competitors the coolest hours for optimum performance and the citizen runners a chance to finish before the temperatures start to drop in the late afternoon if race day is unexpectedly cool.

Reviewing the average high and low temperatures and relative humidity for a proposed race day from historical meteorological data will suggest the likely risk of environmental injury. The risk of heat injury rises above 21°C (70°F) and 50% relative humidity (Ref. 12). The odds ratio for medical illness rises in both the half and full marathon distances if the starting temperature is above 15°C (60°F) (refs. 33, 34). If the historical weather data anticipates an ambient temperature greater than 28°C (82°F) with a relative humidity near 100% in the coolest part of the suggested day, consider scheduling the race for a cooler time of the year. Mass participation races greater than 5K distance with anticipated high humidity and ambient temperature greater than 18°C (65°F) during the race require a start near sunrise or sunset. A similar guideline is optimal for elite competitions to maximise performance. In urban areas, it is important to consider the stored heat energy that accumulates in the streets and buildings during a hot, sunny day. If the year-to-year weather conditions are less than ideal, the race start time should be moved to the coolest part of the day. If the expected conditions at the coolest part of the day are in the higher risk ranges, the race date should be changed to a cooler part of the year. For cold-weather races, start times should be postponed to the warmer parts of the day in high-risk temperature conditions. If the weather information is not within acceptable risk ranges for the proposed start and finish times, regional and national federation officials should withhold sanctions for the race.

- 2. *Race Day Modifications.*** The primary concern of the medical team is the health and safety of the competitors entered in an event. A hazardous (unsafe) condition protocol should be agreed upon in advance by the race administration and medical team. The ethical considerations of the medical profession require that the Medical Director act in the best interest of the competitors when making recommendations to the race administration. The responsibility of the race administration lies not only with the competitors but with the volunteers staffing the course who may also be at risk during hazardous weather conditions.
- 3. *Cancellations.*** It is difficult to imagine cancelling a major mass participation event, especially when television and sponsors are involved. The influence of large financial sponsorships and the time constraints of television programming have an impact on the decisions made by race administration

which are separate from the medical and safety issues involving the medical team. The race administration may elect not to follow the medical recommendations based upon their constraints. In these circumstances, it is recommended that the Medical Director present the medical recommendations to the competitors prior to the start of the race to give the competitors the necessary information to reach an individual participation decision. There is very little question that a race would be postponed during a lightning storm or tornado, or cancelled for a hurricane. Extreme heat and cold stress are equally hazardous to the health and safety of the competitors, and event modification, including cancellation may need to be considered. A death due to heat or cold in a competition held in extreme conditions is a preventable occurrence and competitors depend on the race administration to act in their best behalf. A strong working relationship between the Medical Director and the Race Director will facilitate an intelligent analysis of the risks and the benefits of altering the event through postponement or cancellation. The liability for such decisions will most likely be shared by both parties if an adverse outcome is experienced during the event.

- 4. *Medical Considerations.*** The medical team and event administration should be especially cautious of a warm race day following several days of cool weather or an extremely hot, humid race day which is preceded by one or more extremely hot days, as the risk of exertional heat stroke rises dramatically in these situations. In these cases, acclimatisation may not be ideal or the competitors may enter the competition dehydrated from the previous heat exposure. If the race day is unexpectedly hot and the decision is made to start the event, announce before the race that many runners will not be acclimated to the heat or fully hydrated, and will be at increased risk for collapse and heat stroke. In severe cold conditions, cautions for appropriate dress, hydration, and hypothermia and frostbite risk should be given in the pre-race announcements.

The risk of heat illness increases above 21°C (70°F) and 50% relative humidity. The American College of Sports Medicine has suggested a temperature cascade for risk modification in endurance running events utilising the wet bulb globe temperature (WBGT) which measures the combined thermal stress from the wet bulb (WBT), dry bulb (DBT), and radiant energy or black globe (BG) thermometers. The $WBGT = 0.7WBT + 0.2BG + 0.1 DBT$. Some authors have called the WBGT the Heat Stress Index (HSI). A corresponding colored flag system can be used to visually signal the thermal injury risk of current weather conditions to competitors.

5. **Environmental Stress Indices.** The WBGT and colour coded flags to indicate the risk of thermal stress are :

BLACK FLAG : Extreme Risk - When WBGT is above 28°C (82°F). Races should be cancelled, postponed, or modified if conditions exceed this level at starting time. If unable to cancel or modify the event, it may be prudent to advise the participants of the risks and advise no competition.

RED FLAG : High Risk - When WBGT is 23-28°C (73-82°F). This signal would indicate that all runners should be aware that heat injury is possible and any person particularly sensitive to heat or humidity should not run. Advise participants to slow pace and stress adequate, but not excessive, hydration.

YELLOW FLAG : Moderate Risk - When WBGT is 18-23°C (65-73°F). It should be remembered that the air temperature and radiant heat load will increase during the course of the race if conducted in the morning or early afternoon. Participants with high risk for heat stroke should withdraw from the competition.

GREEN FLAG : Low Risk - When WBGT is below 18°C (65°F). Participation should be safe, but this does not guarantee that heat injury will not occur, only that the risk is low. Both hyperthermia and hypothermia are likely to occur in this temperature range.

WHITE FLAG : Lower risk for hyperthermia, but increasing risk for hypothermia - When WBGT is below 10°C (50°F). Hypothermia may occur, especially in slow runners during long races, and in wet and windy conditions.

The dewpoint temperatures may be used as a guide when the WBGT is not available, but the dewpoint does not measure the radiant heat load from the sun and surroundings. Dewpoints (°F) in the 60s are stressful, 70s are oppressive, and 80s are extremely dangerous for athletes competing at high levels of exertion. Another simple guideline for judging the level of heat stress is to add the ambient temperature in °F to the relative humidity. If the sum is greater than 160, the conditions are very high risk and postponement, modification, or cancellation should be considered.

The temperature cascade developed for the military services may be a reasonable guide for elite competitions. This is an extremely high temperature range for racing and is used by the military to judge the safety of troops in training. It far exceeds the levels recommended by the American College of Sports Medicine for road racing in the heat.

WBGT Military Guide
(°C/°F) (Barthell 1990)

26/78	Caution for heat stroke
28/82	Discretion for unseasoned troops - no heavy exercise
30/85	Suspend exercise if < 3 weeks hot weather training
31/88	Curtail exercise if < 12 weeks hot weather training
32/90	Suspend all training and exercise

In cold conditions, temperatures less than 32°F (0°C) with wind chill require clothing precautions for hypothermia and frostbite. At temperatures less than -20°C (-4°F) consideration should be given to postponing races longer than 5K until later in the day, if warmer temperatures are expected. Snow and ice will be most “slippery” with temperatures in the -6 to 0°C (20 to 32°F) range and traction will increase as temperatures drop to colder levels. At lower temperatures, especially less than -29°C (-20°F) or wind chills less than -40°C (-40°F), it may be prudent to cancel all races.

 **Wind Chill Chart** 

