

# Medical Coverage of Endurance Events

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CHAPTER

60

The organizers of endurance events are obliged to provide medical coverage both to enable competitors to have immediate access to optimal management of medical problems and to relieve the burden on local medical services. These endurance events may include marathons, ultramarathons, triathlons and 'ironman' triathlon events, as well as long-distance events such as walking, swimming, cycling and cross-country skiing. Many of these events will have large numbers of competitors with varying degrees of fitness.

Blisters, bruises, lacerations and muscle cramps are the cause of a large number of presentations to the medical tent at these events. Overuse injuries may develop or may be aggravated in athletes by competing in an endurance event, whereas traumatic injuries may occur as a result of a fall in a crowded running field or from a bike, for example. Thermal injuries (heatstroke or hypothermia) are common in endurance events (Chapters 53 and 54). As there is the possibility of cardiovascular collapse during such events, appropriate facilities must be available.

The precise details of the medical services required will depend on the particular sport, the duration and intensity of the activity and the prevailing environmental conditions. Medical teams that have worked at endurance events for years are able to predict the expected numbers of casualties. It is vital to keep medical records for all athletes treated at a particular event and to analyze these data for historical trends (Table 60.1). We will consider a marathon foot race with 1000 competitors as the basis for our recommendations. The figures should be adjusted according to the type of events and the number of competitors.

**Table 60.1** The expected percentage of race starters likely to be admitted to the central medical care facility at a sporting event with 1000 competitors<sup>1</sup>

Activity	Percentage of race starters
Running	
42 km	2–20
21 km	1–5
Ultratriathlon >200 km	15–30
Cycling	5
Cross-country skiing	5

## Race organization

Specific pre-race strategies to enhance the safety of the competitors include the following:

1. Schedule the race at a time of year and day when environmental conditions will not adversely affect performance or health. The medical director of the race should have the authority to cancel the race should adverse weather conditions prevail. The American College of Sports Medicine position statement recommends that if the wet bulb globe temperature index is above 28°C (82°F) or if the ambient dry bulb temperature is below -20°C (-4°F), organizers should consider canceling or rescheduling the event.<sup>2</sup>
2. Ensure adequate provision of carbohydrate-containing fluids en route, as this is essential.
3. Plan the race course so that the start and finish are in an area large enough to accommodate all spectators and race finishers, medical facilities

and quick get-away routes for emergency vehicles. Place first-aid stations along the route at points allowing for rapid access by emergency vehicles and ideally about 3–5 km apart.

4. Set preparticipation screening and qualification standards to ensure that unfit and inexperienced athletes do not place themselves at undue medical risk during the event.
5. Provide pre-race seminars for participants by medical personnel, as this can reduce the number of casualties. Advice may include:
  - (a) correct training
  - (b) consumption of sufficient carbohydrate before the race
  - (c) eating a pre-race breakfast and drinking approximately 500–800 mL of a 4–7% carbohydrate solution every hour during the race
  - (d) warning of the dangers of competing during or shortly after a febrile illness or while taking medications.
6. Ensure registration forms include questions regarding past and present medical history. This enables identification of, for example, athletes with diabetes, asthma and coronary artery disease. Such athletes could be sent specific information advising them on safety precautions such as wearing a medical bracelet.
7. Implement an ‘impaired competitor’ strategy. Strategically positioned first-aid helpers should be permitted to stop athletes who appear ill and unable to finish the course. There should be vehicles to transport these competitors to the finish line.
8. Advise the local hospital emergency department of the forthcoming race and the likely number and nature of casualties.
9. Hold meetings between the various members of the medical team (see below).
10. Ensure an emergency transport service is available to bring problem cases to the central medical facility or to the nearest hospital emergency facility. Helicopter evacuation has proven invaluable for prompt treatment of athletes suffering cardiac arrest and other life-threatening conditions.

## The medical team

A medical director of appropriate expertise should be appointed a number of months prior to the staging of an endurance event to work closely with the event

director. Early appointment of a medical director permits him or her to implement the pre-race strategies outlined above.

The medical director is responsible for the preparation of medical services and the supervision of the medical team on the day of the event. As endurance events are commonly held over a large area, communication between the different members of the medical team is the highest priority. The medical director should ensure adequate means of communication are available through the use of a two-way radio system or cellular network system.

The medical team should consist of appropriately trained doctors (sporting injuries and medical emergencies), physiotherapists, sports/athletic trainers, nurses, podiatrists and masseurs. For an endurance event with 1000 competitors, the medical team should number approximately 20, of which at least one-third should be doctors. Approximately 60% of the medical team should be situated in the medical areas near the finishing line, 10% of the medical team should be at the finish line itself, 20% of the medical team should be distributed at the first-aid stations along the route and 10% of the medical team should be patrolling the route in road cars, bicycles or ambulances. In shorter events, a greater proportion of the medical team should be situated near the finish line.

The medical team should practice performing emergency procedures, athlete evacuation and rapid assessment of the collapsed athlete prior to the event. At peak periods in a large race of 10 000–20 000 competitors, it is common to have four to six athletes requiring attention every minute—a much faster rate of admission than even the busiest inner-city trauma centers. Thus, the medical team must have procedures well rehearsed. This preparation period also provides the medical director the opportunity to ensure that all caregivers are using the most recent, evidence-based guidelines for the management of casualties.<sup>3,4</sup> In large events (>3000 competitors) or in adverse environmental conditions, at least one fully equipped mobile intensive care ambulance should be in attendance near the finish line. In small events, the ambulance service should be notified that the event is taking place.

## First-aid stations

First-aid stations should be placed en route at strategic positions, providing a stretch and massage facility for cramping muscles, first aid (plasters, bandaids) for chafing skin and blistered feet, and identification of the at-risk runner who is confused or delirious.

These stations provide a center from which athletes can be transported to the central medical facility or to a nearby hospital emergency department. Thus, stations should be positioned in areas that have good access to exit routes as needed.

In running events, first-aid stations should be about 3–5 km apart. Practitioners skilled in treating common musculoskeletal problems and administering emergency first aid should staff these. A doctor should staff each of a number of first-aid stations. All first-aid stations should be in communication with the medical director. In larger events, a road car or ambulance should patrol the course with a doctor in attendance.

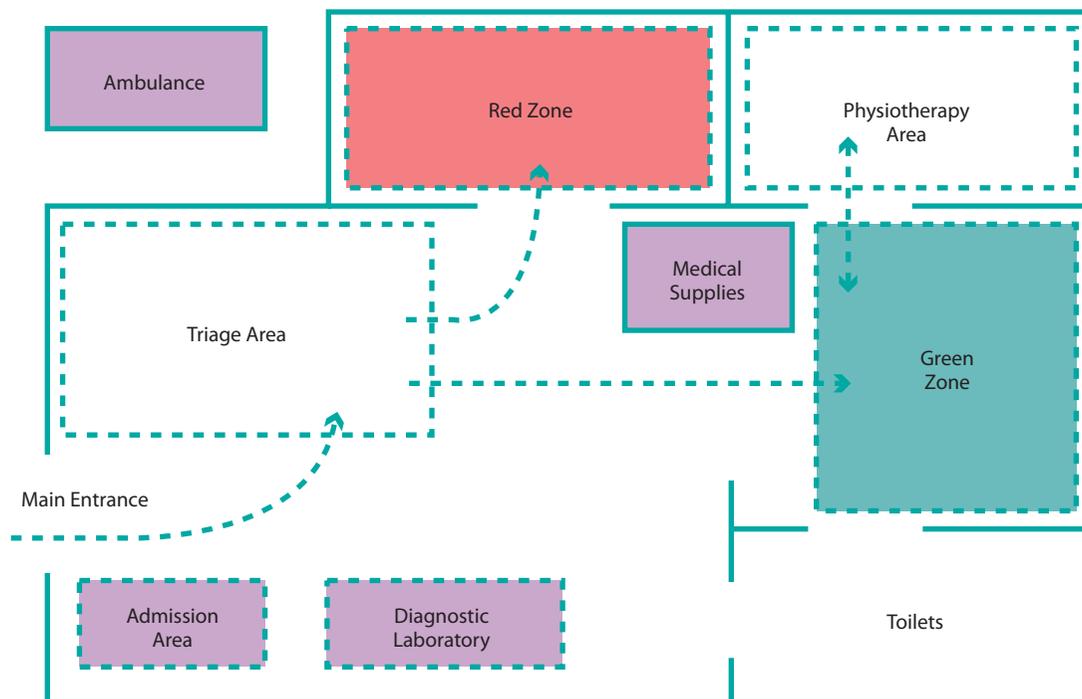
Drink stations are usually situated next to first-aid stations. It is important that the two be separated by at least 50 m so that the large crowds passing through the drink stations do not interfere with first-aid management. Additional drink stations should be situated at approximately 2–2.5 km intervals in events such as a marathon.<sup>5,6</sup> For events lasting less than 1 hour, water is the fluid of choice for rehydration. For longer events, a glucose–electrolyte drink

is preferred in order to improve endurance and to prevent hypoglycemia.

## Medical facility at the race finish

The layout of the central medical station will depend on the facilities available to the race organizers. Figure 60.1 shows the floor plan of the medical facility at the end of the 56-km Two Oceans ultramarathon foot race held annually in Cape Town, South Africa.<sup>1</sup> The green and red zones are for non-severe and severe cases, respectively. Other areas are allocated for the diagnostic laboratory, physiotherapy, medical supplies and toilets.

Note that the red zone for emergencies such as cardiovascular collapse, hypothermia and heatstroke is best located immediately adjacent to the triage station. The red zone can be constructed to afford a degree of privacy for distressed or seriously ill patients and permit discrete measurement of rectal temperatures. This area should be staffed by emergency



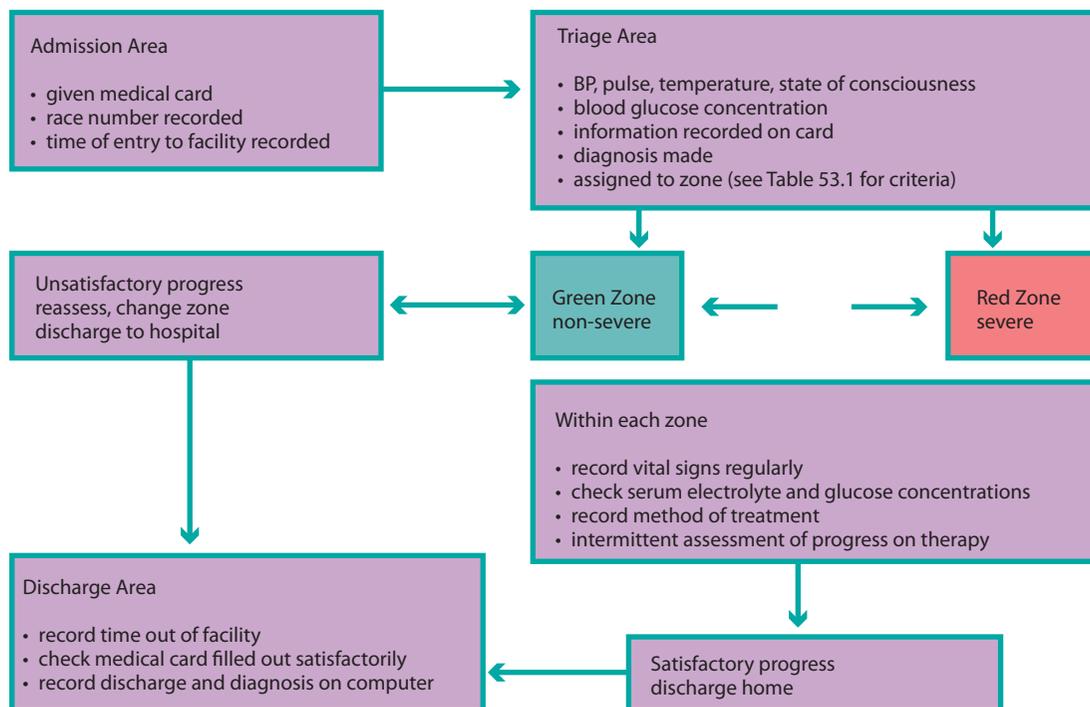
**Figure 60.1** Floor plan of the medical facility located at the finish line of the 56-km Two Oceans ultramarathon foot race held in Cape Town, South Africa

trained doctors and nurses. An ambulance should be located next to the red zone to allow rapid transport of emergency cases.

The benefit of this type of system over the undifferentiated medical tent that was prevalent in the past is that potentially lethal emergencies are much less likely to be overlooked in the general hustle and bustle of athletes with numerous important but not life-threatening musculoskeletal problems. Figure 60.2 provides guidelines for the activities that need to be completed in each of the areas.

The equipment needs for a race medical center include the following:

1. Chairs and tables for the computer operator at the admission area, for the laboratory technologist and the diagnostic equipment, and for the other medical equipment and drugs.
2. Stretchers for transporting collapsed athletes from the race finish to the medical facilities. These are also used for athletes to lie on in the green and red zones. Stretchers must be rigid so the foot can be elevated and collapsed athletes can be nursed, at least initially, in the head-down position (Chapter 53). Some A-frame stands are needed to elevate the foot of the stretcher. These are removed once the athlete's cardiovascular status has normalized.
3. Blankets for each stretcher. These allow for discrete measurement of rectal temperature (Chapter 53) and treatment of hypothermia (Chapter 54).
4. Plastic baths large enough to accommodate the torso of 40–90 kg (6.3–14.5 stone) athletes. These are filled with ice water and are used to treat heatstroke (Chapter 53).
5. Refrigerator facility—a mobile refrigerator truck is ideal for large races.
6. Computer terminal linked to the race finish.
7. Blood electrolyte and sodium analyzers. Ideally, serum sodium and potassium concentrations should be measured in all patients. However, this is essential in all subjects who are diagnosed as 'dehydrated'



**Figure 60.2** Suggested flow chart for the management of athletes once they enter the central medical facility (see Fig. 60.1)

and in need of intravenous fluids. A serum sodium concentration below 130 mmol/L (130 mEq/L) indicates that the athlete is more likely over- rather than under-hydrated.

8. Bins for rubbish and 'sharps'.
9. Toilet facilities.
10. Medications and equipment. Table 60.2 lists the resuscitation and medical equipment and Table 60.3 the medications required to cope with the expected emergency conditions. A pharmacist should be present to control the distribution of medications.

11. Given that over 60% of runners requiring attention after a marathon require physiotherapy services, it is ideal if a separate physiotherapy area can be set aside from the central medical facility. Many endurance events also provide a massage tent for athletes. As there are often a large number of minor foot injuries associated with endurance running events, the presence of a podiatrist is of great assistance also.

Additional supplies required for the medical tents and first-aid stations are shown in the boxes on page 974.

**Table 60.2** Essential resuscitation and diagnostic tools for an endurance sporting event with 1000 competitors

Resuscitation tools	Diagnostic tools
Oral airways (sizes 6–8)	Stethoscopes (5)
Resuscitation masks (disposable)	Sphygmomanometers for blood pressure measurement (5)
Defibrillator	Rectal thermometers (5 with disinfectant)
Oxygen cylinder/mask (2)	Torches
	Ophthalmoscope and otoscope
	Glucometers for blood monitoring (2)
	Reflex hammer
	Blood electrolyte analyzer
	Urine sticks
	Peak flow meter (1)

**Table 60.3** Basic medications required in the medical facility at endurance sporting events with 1000 competitors

Mode of administration	Medication
Injectable	Atropine (0.4 mg/mL) Dexamethasone (4 mg/mL) Morphine sulfate 15 mg/cc Dextrose 50% Adrenalin (epinephrine) (1:1000) (1 mg/mL) Salbutamol for nebulizer Metoclopramide Cardiac resuscitation drugs: atropine, lignocaine (lidocaine), frusemide Xylocaine (local anesthetic) Tetanus toxoid
Inhalation	Salbutamol inhaler
Oral	Paracetamol (acetaminophen) (500 mg) Sublingual glyceryl trinitrate (nitroglycerin) (0.4 mg) Isordil spray Chlorzoxazone tablets (500 mg) Loperamide capsules (2 mg)
Topical	Propacaine (0.5%) eye anesthetic Water-soluble lubricant Povidone iodine Tincture of benzoin

### Supplies required for medical stations at the finish line of a marathon with 1000 competitors

Surgical instruments and disposables  
 Scissors  
 Latex gloves  
 Syringes (3 mL, 5 mL, 10 mL)  
 Needles (18, 21, 25 gauge)  
 Steri-strips, bandaids  
 Skin disinfectant  
 Adhesive bandages  
 Gauze pads  
 Suture equipment (disposable)  
 Space blanket  
 Fluid administration sets; cannulas, poles, giving sets (10)  
 Normal saline for intravenous use (10 × 1 L)  
 5% dextrose for intravenous use (2 × 1 L)  
 Haemacel for intravenous use (2 × 1 L)

### Other equipment

Ice and plastic bags (100 kg of ice)  
 Water (500 L)  
 Glucose–electrolyte drink (to make 250 L)  
 Cups (2000)  
 Towels  
 Blankets (10) and space blankets  
 Rigid-frame stretchers (10)  
 Nebulizer (2)  
 Inflatable arm and leg splints (2 each)  
 Slings (5)  
 Rigid strapping tape (various sizes)  
 Elastic bandages (various sizes)  
 Tape scissors  
 Dressing packs (10)  
 Eye pads  
 Petroleum jelly  
 Pens and paper for record collection  
 Laptop computer for data entry  
 Athletic trainer's kit  
 Podiatrist's kit (scalpel, sharp scissors, disinfectant, skin care pad, adhesive felt)

## Conclusion

The risks associated with endurance events can be reduced with adequate preparation, good medical coverage on the day of the event and, most importantly, education of the competitors. Educating the

### Supplies required at a first-aid station along a marathon course with 1000 competitors

Stretchers (5)  
 Blankets (5)  
 10 cm (4 in.) and 15 cm (7.5 in.) elastic bandages (6 each)  
 Gauze pads  
 Rigid strapping tape  
 Dressing packs (5)  
 Skin disinfectant  
 Inflatable arm and leg splints (1 each)  
 Athletic trainer's kit  
 Petroleum jelly  
 Pen and paper for record collection

competitors regarding some of the pitfalls of competing in an endurance event will not only improve their performance but will also reduce the risk of any major problem developing.

Medical input into the planning of the event is essential. The risk of thermal injury is reduced if the event is held at a time that is likely to avoid extremes of heat or cold. Events held in warmer climates should be commenced early in the morning or in the evening. Adequate facilities and equipment should be provided with well-stocked, regular drink stations along the route.

The presence of experienced, trained medical and paramedical staff to deal with any emergency will dramatically reduce the risk of serious problems. A functional layout of the medical facility can permit rapid, appropriate care of all race participants.

## Recommended Reading

- Hew-Butler T, Almond C, Ayus JC, et al. Exercise-Associated Hyponatremia (EAH) Consensus Panel. Consensus statement of the 1st International Exercise-Associated Hyponatremia Consensus Development Conference, Cape Town, South Africa 2005. *Clin J Sport Med* 2005; 15(4): 208–13.
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history of exercise induced hyponatremia. *Med Sci Sports Exerc* 2001; 33(9): 1434–42.

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2. Armstrong LE, Epstein Y, Greenleaf JE, et al. American College of Sports Medicine position stand. Heat and cold illnesses during distance running. *Med Sci Sports Exerc* 1996; 28(12): i–x.
3. Noakes TD, Sharwood K, Speedy D, et al. Three independent biological mechanisms cause exercise-associated hyponatremia: evidence from 2,135 weighed competitive athletic performances. *Proc Natl Acad Sci U S A* 2005; 102(51): 18550–5.
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6. Reid SA, Speedy DB, Thompson JM, et al. Study of hematological and biochemical parameters in runners completing a standard marathon. *Clin J Sport Med* 2004; 14(6): 344–53.