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## SPORTS

Exercise has clear benefits to both health and quality of life (Ch. 36). However, there are occasional sudden deaths (Table 33.1) and there may be risks from trauma, such as in sports, sometimes from other issues such as travel, and occasionally from associated disordered eating, menstrual disturbances and supplement use.

## TRAUMA

See also Chapter 24 and <http://www.aans.org/> (Sports-related head injury is under the Patient information/Conditions and Treatments tabs; accessed 30 September 2013).

Head, orofacial, ocular and other injuries are a risk in many sports; therefore the wearing of helmets and eye, face, jaw and mouth protection is often indicated, along with other protection.

### Motion sports

Head injuries and maxillofacial and dental trauma are all too common in any sport involving fast movement, including those involving vehicles, roller-blading, skateboarding, snowboarding and skiing. Indeed, trauma is possible in all motion sports and as new types of sports become popular, the injuries associated with them also increase. Helmets are mandatory and, in some instances, protection for eyes, jaws, hands, knees, elbows and wrists is indicated.

### Contact sports

Contact sports include football (soccer and rugby), boxing, martial arts (e.g. wrestling, karate and judo), gymnastics and hockey; to a degree, there is contact in some other sports such as baseball and basketball. Injuries to the teeth and orofacial soft tissues are common, particularly in football, boxing, martial arts and hockey.

Most sports injuries affect the maxillary incisors and involve young males. In soccer and rugby, players have about a 10% chance of injury per season. This may include head injury, cerebral concussion and neck injuries, which can be fatal or lead to paraplegia. Maxillofacial and dental injuries account for about 13% of the costs of all soccer injuries.

Prevention and adequate preparation are the key elements in minimizing injuries from such sports. Teaching skills such as tackling, use of appropriate equipment, safe playing areas and the wearing and utilization of properly fitted protective equipment like helmets and mouthguards are essential. A properly fitted mouthguard may also reduce the chances of sustaining a concussion from a blow to the jaw. Mouthguards are usually made of vinyl or acrylic, and three main types are available (Box 33.1).

### Non-contact sports

Non-contact sports, such as tennis and volleyball, can also be dangerous. Custom-made protectors could offer the best protection against dental damage.

### Box 33.1 Mouthguards

- Custom-made protectors – offer the best protection (vacuum custom-made and pressure laminated custom-made, ethylene vinyl acetate [EVA])
- Mouth-formed protectors – moulded on to the teeth ('boil and bite'); give variable protection but are useful where orthodontic appliances are worn
- Stock protectors – cheap and easily adjusted but less comfortable, protective or retentive

## Water sports

Athletes who swim more than 6 hours per week in pools chemically treated to maintain safe water quality standards may develop tooth stains misnamed 'swimmer's calculus' and/or tooth erosion. The stains can usually be removed with professional cleaning.

Scuba divers depend on air in the form of compressed air from a tank, transmitted to the mouth by way of a regulator held in the mouth by the teeth, so that there is an airtight seal between the teeth and lips. Inability to hold the mouthpiece because of missing teeth poses a contraindication to scuba diving. Dental concerns in divers include temporomandibular joint (TMJ) and muscle pain from holding the regulator ('diver's mouth syndrome'), barotrauma and barodontalgia (from the effects of pressure changes), and the management of prostheses. Many divers experience TMJ and/or facial muscle pain or headache from the continuous jaw clenching. Mouthpieces are usually made of neoprene or silicone rubber and are held in place by bite tabs that fit into the dentition at the canine and premolar area. The average dive lasts 30–60 minutes and requires constant jaw muscle effort. Extending the bite tabs to cover the molar teeth balances the weight of the regulator and can relieve stress on the TMJ.

Barodontalgia (pain in the tooth caused by pressure changes) can arise in divers (or people in aircraft or at high altitude) if there are pulp lesions, abscesses or sinusitis. Antral pain may have a similar cause. Teeth that have been opened for endodontic treatment and temporarily sealed have been known to explode from air trapping and expansion on surfacing – mainly in deep divers using a helium–oxygen mixture. Full porcelain crowns can also shatter from relatively shallow dives of 65 feet. Raised pressure in the middle ear can occasionally cause facial palsy (baroparesis) but this typically resolves spontaneously over a few hours.

Divers cannot wear full or partial dental prostheses while diving, as they may be dislodged and aspirated. To eliminate the possibility of dislodgment completely, a custom mouthpiece to obviate the chance of aspiration of the prosthesis can be made. Full arch impressions are taken with the patient holding silicone putty in the roof of the mouth until it is set; they are then mounted in a hinge articulator and sent to the laboratory with the silicone putty impression.

## DRUG USE IN SPORTS

Further information is available at: <http://sportsanddrugs.procon.org/> (accessed 30 September 2013).

**Table 33.1** Endogenous causes of sudden death in athletes

Cardiac causes	Other causes
Anomalous origin of coronary artery	Alcohol
Aortic rupture (Marfan syndrome)	Amphetamine
Aortic stenosis	Cocaine
Coronary artery disease	Erythropoietin (EPO)
Electrical conduction system abnormalities	Head trauma
Hypertrophic cardiomyopathy	Vascular event
Long QT syndrome	
Myocarditis	
Obstructive cardiomyopathy	
Right ventricular dysplasia	

**Table 33.2** Substances and methods not permitted for use by athletes<sup>a</sup>

Prohibited at all times	Prohibited in competition	Prohibited in certain sports
S1 Anabolic agents	S6 Stimulants	Alcohol
S2 Peptide hormones, growth factors and related substances	S7 Narcotics	Beta-blockers
S3 Beta agonists	S8 Cannabinoids	
S4 Hormone and metabolic modulators	S9 Glucocorticosteroids	
S5 Diuretics and other masking agents		
M1 Manipulation of blood and blood components		
M2 Chemical and physical manipulations		
M3 Gene doping		

<sup>a</sup>The World Anti-Doping Agency (WADA) is responsible for maintaining and updating this list. See <http://www.wada-ama.org/en/World-Anti-Doping-Program/> (under 'International Standards/Prohibited List'; accessed 30 September 2013).

Sports people may wish to take drugs as medication for disease; to improve their performance (performance-enhancing drugs; PEDs) and, in doing so, to gain an unfair advantage; or for 'recreational' reasons. Some substances are banned only during competition, while others depend on the method of administration (e.g. inhalation versus tablet or injection form). The list of prohibited substances is updated annually to keep up with advances in science and technology, a new list being issued on 1 January. A substance is added to the list if it meets two of the three criteria listed:

- The potential for enhanced performance
- The potential for being detrimental to health
- Violation of the spirit of sport.

The International Olympic Committee permits or prohibits the use of various drugs (Table 33.2). A comprehensive list of banned substances from the World Anti-Doping Agency (WADA) is available at: <http://www.wada-ama.org/en/World-Anti-Doping-Program/> (under 'International Standards/Prohibited List'; accessed 30 September 2013).

Some drugs are banned at all times; others are permissible when not competing but not during competition; and some are banned in some sports but not others. Banned substances can include alcohol and caffeine above a certain level. Some agents are permitted for use for certain complaints (Table 33.3). In some cases, an athlete may have a pre-existing medical condition that requires them to take medication

**Table 33.3** Examples of agents permitted for use by athletes for certain complaints<sup>a</sup>

Complaints	Drugs permitted
Allergies	Astemizole, cetirizine, chlorphenamine, loratadine, terfenadine
Diarrhoea	Diphenoxylate, loperamide
Bacterial infections	Antibiotics (all)
Fungal infections	Amphotericin, fluconazole, nystatin, miconazole, terbinafine
Viral infections	Aciclovir, idoxuridine
Asthma	Cromoglicate, theophylline, fluticasone (under specific conditions), beclomethasone, salbutamol, formoterol, terbutaline, salmeterol
Coughs and colds	Antihistamines, dextromethorphan, guaifenesin, pholcodine
Oral or ear, nose and throat problems	Sprays or drops containing: betamethasone, dexamethasone, docusate, hydrocortisone, beclomethasone, fluticasone, tramazoline
Eye problems	Ointments or drops containing: antazoline, betamethasone, hydrocortisone, beclomethasone, chloramphenicol
Hay fever	Antihistamines
Pain and inflammation	Aspirin, paracetamol (acetaminophen), non-steroidal anti-inflammatory drugs (NSAIDs), codeine, dextropropoxyphene
Nausea and vomiting	Cimetidine, cinnarizine, domperidone, metoclopramide, prochlorperazine

<sup>a</sup>Check with governing bodies, as regulations may vary, or apply under specific circumstances/conditions.

that is listed. In this case, the athlete can apply to their international federation for a Therapeutic Use Exemption (TUE), which must be verified by their physician. In order for their request to be accepted, the following must be true:

- The athlete would suffer significant health problems if they do not take the medication
- There is no suitable alternative that is not listed
- There are no considerable performance-enhancing benefits.

### Anabolic steroids

Anabolic steroids are available legally by prescription only, for conditions in which the body produces abnormally low amounts of testosterone, such as delayed puberty and some types of impotence. They are also used to treat body wasting in, for example, patients with human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS). Athletes (and others) may misuse anabolic (androgenic) steroids (AAS) – synthetic substances related to male sex hormones – to enhance performance (and also to improve physical appearance); these are taken orally or injected, typically in cycles of weeks or months ('cycling'), rather than continuously. There are two types of AAS:

- *Exogenous*: synthetic versions of testosterone. Common examples include nandrolone and danazol.
- *Endogenous*: naturally occurring substances involved in the metabolic pathways of testosterone. For testing of drug use, all endogenous steroids have a normal range. Results outside of this normal range are deemed positive.

Due to the enhancement of testing procedures in the detection of anabolic steroids, 'designer steroids' such as tetrahydrogestrinone (THG) have been developed. THG breaks down during the preparation

method used for normal steroid testing procedures. A test specifically for the detection of THG has since been developed.

Anabolic steroids given to adolescents may accelerate pubertal changes and cause premature skeletal maturation, halting growth. The major toxic effects include kidney and liver tumours (and jaundice), fluid retention and hypertension, increases in low-density lipoprotein (LDL) and decreases in high-density lipoprotein (HDL), severe acne, trembling, hostility and aggression, and other psychiatric effects. Gender-specific adverse effects include: for men – testicular atrophy, low sperm count, infertility, baldness, breast development and prostate cancer; and for women – facial hair growth, baldness, menstrual changes, clitoris enlargement and deepened voice. Injecting anabolic steroids is also associated with the risk of contracting or transmitting HIV or viral hepatitis.

### Blood doping

Blood doping is the process of artificially increasing the amount of erythrocytes in an attempt to improve athletic performance. In the past this was accomplished by autologous transfusion, a practice now outlawed. Erythropoietin (EPO) stimulates erythrocyte production and is also illegal. It increases blood viscosity, may lead to thromboses and is one of the causes of the ‘sudden death syndrome’ seen in occasional athletes (see Table 33.1 and [www.ukssport.gov.uk](http://www.ukssport.gov.uk); accessed 30 September 2013).

There are major side-effects associated with erythropoietin use, which have proven to be fatal in previous cases:

- Increased blood viscosity (which increases the risk of heart attack and stroke)
- Fever
- Seizures
- Nausea
- Headache
- Anxiety.

### Human growth hormone

Human growth hormone (hGH), sometimes known as somatotrophic hormone or somatotropin, is credited with having the following effects:

- Increased muscle mass
- Decreased fat stores
- Accelerated muscle recovery

Many small studies, however, have shown no increases in muscle size or strength following injection with hGH. A common practice among body-builders and weightlifters is to combine hGH and anabolic steroids, with recent research demonstrating beneficial effects.

The side-effects of hGH are vast and some are serious:

- Gigantism (pituitary gigantism or giantism) in younger athletes (abnormally excessive growth in height, considerably above average)
- Acromegaly in adult athletes (a condition in which the pituitary gland produces too much hGH, resulting in the growth and swelling of body parts, typically hands, feet, nose but possibly progressing to brow and jaw protrusion and swelling of internal organs)
- Hypothyroidism (low production of thyroid hormone, which disrupts metabolic rate and protein production)
- Cardiomyopathy (disease of the cardiac muscle, increasing the risk of arrhythmia and sudden cardiac death)
- Cardiac failure
- Hypercholesterolaemia (presence of high levels of cholesterol in the blood)

- Ischaemic heart disease (a lack of blood to the heart, often due to coronary artery disease)
- Myopathies (neuromuscular diseases affecting the function of muscle fibres)
- Arthritis
- Diabetes
- Impotence
- Osteoporosis
- Menstrual irregularities in women
- Creutzfeldt–Jakob disease (CJD or mad cow disease; transmission is possible when hGH is obtained from cadavers).

### Insulin-like growth factor

Due to its perceived anabolic effects, athletes use insulin-like growth factor (IGF)-1 to increase muscle mass and strength, although clinical studies have not proven that it does so. It is thought that it is actually IGF binding protein-3 that is responsible for growth, rather than the growth factor itself. IGF-1 does, however, inhibit cell death and so may have a role in reducing recovery times.

Side-effects of IGF include:

- acromegaly in adult athletes
- organomegaly (the abnormal enlargement of organs)
- hypoglycaemia (lower than normal levels of glucose in the blood)
- cancer (prostate, lung and colorectal cancers have all been reported).

### Human chorionic gonadotrophin

hCG is mainly used by male athletes, as it increases the production of both testosterone and epitestosterone, so keeping the testosterone-to-epitestosterone ratio unchanged from normal values (vital in avoiding detection of the presence of other prohibited substances). It is also used to maintain testicular volume in males who are using anabolic steroids. However, it is now thought that it is follicle-stimulating hormone (FSH) that is responsible for maintaining testicular volume and so hCG use would be entirely ineffective; in females there would be no beneficial effect at all.

Side-effects associated with hCG use are rare and non-serious:

- Gynaecomastia (the development of abnormally large mammary glands in males due to increased levels of the oestrogen).

The combination of hCG and anabolic steroids can cause:

- headaches
- depression
- oedema (swelling caused by fluid within the body's tissues).

### Other substances

Gamma hydroxybutyrate (GHB) is also used by some body-builders. Drugs such as modanafil have been used to help alertness. Other banned substances not described above include:

- adrenocorticotrophic hormone (ACTH)
- beta<sub>2</sub> agonists
- hormone antagonists and modulators
- diuretics
- artificial oxygen carriers
- gene doping
- amphetamines
- ephedra

- cocaine
- caffeine
- narcotics
- cannabinoids
- glucocorticosteroids.

### Smokeless tobacco

Smokeless tobacco is associated with some sports in the USA, and is potentially dangerous in terms of oral keratoses and malignant change.

## EATING DISORDERS IN SPORTS

Some athletes, mainly women, in cross-country, track and field, gymnastics, dancing, figure skating, volleyball and basketball, may be prone to develop eating disorders (Ch. 27). Tooth erosion may then be seen.

In endurance sports, such as long-distance running, triathlons or cycling, athletes may consume a high amount of refined carbohydrates ('carbo-load'), as well as carbohydrate gels or drinks (sports drinks – often containing carbohydrates, electrolytes, B vitamins and an acid such as citric, malic, tartaric or phosphoric).

Further information is available at: <http://www.uk sport.gov.uk/publications/eating-disorders-in-sport> (accessed 30 September 2013).

## DENTAL ASPECTS IN SPORTS

Preventive dental care and prevention of caries and erosion are important. Operative care for athletes under local anaesthesia (LA) is permitted. Analgesics such as aspirin, NSAIDs and paracetamol (acetaminophen) are permitted but opioids are banned and opiate-related analgesics are problematical. Codeine is not on the WADA list of banned substances, and combinations such as co-codamol and co-proxamol appear acceptable, but as screening does not always differentiate adequately between the various narcotic or codeine-related compounds, they are best avoided.

Anxiolytics may sometimes be banned. Alcohol and beta-blockers are illegal in certain sports, and therefore alcohol-containing oral health-care products are also best avoided. Some vitamin, herbal and nutritional supplements are banned.

Antimicrobials of all types are generally permitted. Therapeutic preparations used for topical oral use are also generally permitted; for example, topical corticosteroids are permitted but systemic corticosteroids are best avoided, or a TUE is required.

## TRAVEL AND LEISURE

International travel is undertaken by ever-growing numbers of people for social, recreational, professional and humanitarian purposes, and can result in a variety of health risks in unfamiliar environments that present variable levels of risk and standards of health care, as well as the transmission of infectious agents and the appearance globally of diseases hitherto confined to certain areas. Most problems can be minimized by common sense, with suitable precautions taken before, during and after travel (see UK Department of Health booklet *Health advice for travellers* [T7.1], Fig. 33.1; available at [http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_4123441](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4123441), accessed 30 September 2013).

The countries to be visited and the duration of the visit are important in determining the likelihood of exposure to many problems, such as violence and infectious agents, and will influence decisions on the

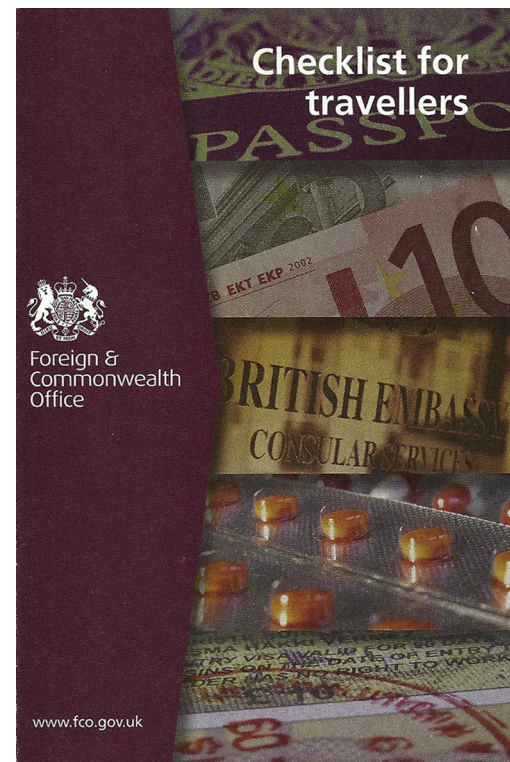


Fig. 33.1 *Health advice for travellers* – a sensible read.

need for protection and certain vaccinations or antimalarial or other medication. The behaviour of the traveller is also important: exposure to the risk of assault or accidents, or to insects, rodents or other animals, infectious agents and contaminated food and water, is often a lifestyle choice. A business trip to a city in the high-income world, for instance, typically involves far fewer risks than a visit to remote rural areas in the tropics. For example, going outdoors in the evenings in a malaria-endemic area without using precautions, such as wearing protective clothing, applying repellents and taking antimalarials, is highly risky. The duration of the visit may also determine whether the traveller may be subjected to wide changes in temperature and humidity, or to other environmental factors.

Travellers are far more likely to be killed or injured in accidents or through violence than to be struck down by an exotic infectious disease. Assaults are common in some areas and lone travellers are particularly vulnerable. Accidents and injuries are common at mass gatherings (where in addition, infections can spread) in mountain sports and other outdoor adventures. Accidents, injuries and infections are also possible in recreational waters in association with swimming, diving, sailing and other activities.

## HIGH ALTITUDES

At high altitude, atmospheric pressure is lowered and the fall in oxygen pressure can lead to hypoxia, as discussed below. At 1500–3500m, exercise tolerance is impaired and ventilation is stimulated. At 3500–5500m, there is hypoxia and altitude sickness is possible.

Rapid ascent may lead to acute hypoxia; the affected person becomes faint and may lose consciousness. Acute mountain sickness may develop after 1–6 hours at high altitudes; headache is followed by anorexia, nausea and vomiting, insomnia, fatigue, lassitude and irritability. The outcome is sometimes fatal due to the development of pulmonary and cerebral oedema.

Travellers making a rapid ascent to high altitude (over 3000m) can consider prophylactic medication (acetazolamide). Those planning to climb or trek at high altitude benefit from a period of gradual adaptation.

## FLYING

*Flight phobia* (fear of flying) is common, particularly since 11 September 2001. There also appears to be an increase in the use of alcohol on flights, with air rage – a form of disruptive behaviour – linked to high levels of stress and frequently precipitated by alcohol.

*Dehydration* is common. Cabin humidity is low, usually less than 20%, and may cause discomfort of the eyes, mouth and nose, especially in Sjögren syndrome. Fluid should be taken to prevent dehydration – non-alcoholic beverages (water and fruit juices) rather than alcohol, which contributes to dehydration.

*Deep vein thrombosis* (DVT; Ch. 8) can develop from prolonged immobility leading to pooling of blood, which is probably aggravated by dehydration. Most DVTs are in the calves and cause no symptoms; some cause swelling, stiffness and discomfort. They are usually reabsorbed but, occasionally, pulmonary embolism may follow, with serious consequences including chest pain, dyspnoea and even death, sometimes many hours or days later. Exercise and properly fitted, graduated compression stockings specially designed for air travel may be helpful. Aspirin is often advised prophylactically for its antiplatelet activity for long-distance flights, along with ample fluids and exercise in-flight.

*Jet lag* – the disruption of sleep patterns and other circadian rhythms (the body's internal clock) caused by crossing multiple time zones in a short period of time – is commonplace. The adverse effects of jet lag may lead to indigestion, general malaise, insomnia, and reduced physical and mental performance. Melatonin may help resynchronize the body's internal clock.

*Hypoxia* may be experienced because cabin air pressure is relatively low; the blood oxygen saturation is therefore slightly reduced, leading to mild hypoxia. Travellers with pre-existing cardiovascular or pulmonary disease or anaemia (especially sickle cell disease) are highly sensitive to hypoxia, which can be dangerous and even life-threatening.

In people with *ear, nose and sinus or dental infections, or after recent surgery* or injury, there may be pain if air or gas trapped in air-filled body cavities expands. This occurs especially after abdominal trauma and gastrointestinal surgery, craniofacial and ocular injuries, brain operations, and eye operations involving penetration of the eyeball.

*Dental issues* include head and facial barotraumas (barotrauma-related headache, external otitic barotrauma, barosinusitis and barotitis media), dental barotrauma (barometric pressure-related tooth injury) and barodontalgia (barometric pressure-related oro-dental pain). Special considerations may be required when planning restorative, endodontic, prosthodontic and surgical treatment to aircrew. Prevention is crucial, as is periodic examination, good restorative dentistry and flight restriction (grounding) if there are pulpal issues. Dental documentation is important for forensic purposes.

*Infections* can occasionally be transmitted in aircraft, as in any confined space, and even influenza and tuberculosis have been transmitted between passengers on long-haul flights. Modern aircraft recirculate up to 50% of cabin air by passing it through high-efficiency particulate air (HEPA) filters, which clean recirculated cabin air, but incompletely. Viruses in particular can be recirculated. Passengers may occasionally also be infected by *insects* in the aircraft and there have been outbreaks of malaria in the vicinity of airports, due to the escape of transported mosquitoes ('airport malaria').

*Contraindications* to air travel are shown in [Box 33.2](#).

### Box 33.2 Contraindications for air travel

- Infants under 7 days old
- Women in the last 4 weeks of pregnancy (8 weeks for multiple pregnancies) and until 7 days after delivery
- People with serious medical/surgical conditions:
  - Angina pectoris, recent myocardial infarction or stroke
  - Acute contagious disease
  - Decompression sickness after diving
  - Raised intracranial pressure
  - Recent surgery or injury where trapped air or gas may be present
  - Chronic respiratory disease, breathlessness at rest or unresolved pneumothorax
  - Sickle cell disease
  - Uncontrolled hypertension of more than 200 mmHg (27 kPa) systolic pressure
  - Recent psychiatric illness.

## HOT OR HUMID CLIMATES

Exposure to hot, dry, dusty air may cause irritation and infection of the eyes and respiratory tract, and may lead to heat exhaustion and heat stroke. Dehydration is particularly likely unless care is taken to maintain adequate fluid intake. Consumption of salt-containing food and drink helps to replenish the electrolytes in case of heat exhaustion and after excessive sweating.

Fungal skin infections (e.g. tinea) can be aggravated by heat and humidity, and taking a daily shower, wearing loose cotton clothing and applying talcum powder to sensitive skin areas help control their development or spread. Many other infections are also more prevalent in such climes (Appendix 21.9 and Ch. 21).

## SUN EXPOSURE

Ultraviolet (UV) radiation from the sun includes both UVA (wavelength 315–400 nm) and UVB (280–315 nm) radiation. Radiation may penetrate clear water to a depth of 1 m or more. UVB radiation is particularly intense in summer and in the 4-hour period around solar noon. Both forms of UV radiation are damaging to skin and eyes. Adverse acute effects include sunburn, particularly in light-skinned people, acute keratitis ('snow blindness') and actinic cheilitis (solar keratosis). Long-term adverse effects can include accelerated skin ageing, skin cancers (melanoma, basal cell carcinoma and squamous carcinoma), lip cancer (squamous carcinoma), cataracts, photosensitization (to drugs such as oral contraceptives, antimalarials and antimicrobials, and to perfumes containing oil of bergamot or other citrus oils) and immune suppression, increasing the risk of infectious disease and limiting the efficacy of vaccinations.

## INFECTIONS PREVALENT IN THE DEVELOPING WORLD

See Appendix 21.9, and also Chapters 21 and 32.

Some infections are acquired mainly in the tropics but can appear elsewhere, particularly in areas bordering the tropics and subtropics, war zones or places where there are other disasters that lead to poor water and food hygiene, and the proliferation of rodents and other pests. Such infections are increasingly found and imported into high-income countries (e.g. airport malaria, severe acute respiratory syndrome [SARS], bird flu and swine flu) with global warming and the spread of vectors, and with increasing global travel and migration.

**Box 33.3** Main infective hazards associated with travel to developing countries

- Cholera
- Dengue fever
- Dysentery
- Hepatitis viruses (particularly A)
- HIV and other sexually shared infections
- Infective (travellers') diarrhoea (the most common hazard)
- Malaria (the most important hazard) – a significant health risk in the developing world, especially West Africa; in severe falciparum malaria, mortality is ~30% despite appropriate treatment
- Rabies
- Respiratory viruses
- Tuberculosis
- Yellow fever

The main infective hazards are shown in **Box 33.3** but there are many others. Some are potentially lethal, such as dengue fever, which is mosquito-transmitted. Ebola fever, Lassa fever and Marburg disease are highly contagious from human–human contact and are lethal.

## BLOOD-BORNE INFECTIONS

Hepatitis B and C, HIV and other agents can be transmitted by direct contact with infected blood or other body fluids, especially by inoculation.

## SEXUALLY SHARED INFECTIONS

See Chapter 32.

## FOOD-BORNE AND WATER-BORNE HEALTH RISKS

More information on food safety and the prevention of food- and water-borne diseases can be found at: <http://www.cdc.gov/food-safety/diseases/> and <http://www.nathnac.org/pro/factsheets/food.htm> (accessed 30 September 2013).

### Food spoilage

Spoilage bacteria cause food to deteriorate and develop unpleasant odours, tastes and textures, but rarely cause food poisoning. There are different spoilage bacteria and each reproduces at specific temperatures: some at low temperatures in refrigerators or freezers, others at room temperature, and most where they have access to nutrients and water. Some of the conditions that accelerate spoilage also encourage growth of pathogenic microorganisms. Food-borne infections are seen worldwide, especially from shellfish, poultry and milk.

### Food poisoning

A range of microorganisms can enter the body in food in any country if the food is inadequately cooked, or on the food – for example, if the person preparing the food fails to wash their hands before handling it. *Campylobacter* infection in milk and poultry is the most common cause of food poisoning but other common causes include *Salmonella*, *Listeria*, *Shigella* and *Clostridia*. *Escherichia coli* infections can be serious but are uncommon (Ch. 21). Some infections take a few hours to cause symptoms, others a few days. Contaminated food may also

spread a wide range of other infections or infestations, occasionally even worms, such as cysticercosis and echinococcosis (Ch. 21).

### Travellers' diarrhoea

Infections transmitted by ingesting contaminated food and water include 'travellers' diarrhoea' (caused by a wide range of viruses and bacteria); this may affect up to 80% of travellers to high-risk destinations. This is essentially food poisoning, and *E. coli* bacteria are the most common culprit.

Most diarrhoeal attacks are self-limiting, with recovery in a few days. It is important, especially for children, to avoid becoming dehydrated, so fluids (e.g. bottled, boiled or treated water, or weak tea) should be taken. If diarrhoea continues for more than 1 day, oral rehydration salt (ORS) solution should be taken. Antidiarrhoeal medicines (e.g. loperamide) are not generally recommended but may be used exceptionally. If the stools contain blood, medical help should be obtained or a course of antibiotics may be taken (for children and pregnant women, azithromycin; for other adults, ciprofloxacin).

### Norovirus

Noroviruses are a group of viruses that cause gastroenteritis and an acute onset of pain, nausea, and severe vomiting and diarrhoea. Norovirus illness is usually brief in people who are otherwise healthy but can be serious, especially in young children, the elderly, and people with other medical illnesses, who are most at risk for more severe or prolonged infection.

Norovirus can be found early on in the faeces and for 2 or more weeks after recovery. Being infected with one type of norovirus may not protect against other types. Norovirus is a highly contagious virus transmitted from an infected person, contaminated food or water, or contact with contaminated surfaces. Norovirus infection is preventable by proper hand-washing and general cleanliness. It can spread quickly in closed places like restaurants, daycare centres, nursing homes, schools and cruise ships.

Foods implicated include

- leafy greens (such as lettuce)
- fresh fruits
- shellfish (such as oysters).

### Recreational water illnesses

Chlorine is used to decontaminate recreational water but does not kill all microorganisms instantly; some are very tolerant to chlorine and were not known to cause human disease until recently. Recreational water illnesses (RWIs) are increasing, and include gastrointestinal, skin, ear, respiratory, eye, neurological and wound infections. RWIs are spread by swallowing, breathing in mists or aerosols of, or contact with contaminated water in swimming pools, hot tubs, water parks, water play areas, interactive fountains, lakes, rivers or oceans. RWIs can also be caused by chemicals in the water or chemicals that evaporate from the water and cause indoor air quality problems.

Legionellosis is sometimes an RWI. The most common ones, however, are cryptosporidiosis (diarrhoea caused by *Cryptosporidium*) and *Giardia*, *Shigella*, norovirus and *E. coli* O157:H7. The most common causes of gastroenteritis are certain viruses. In children rotavirus is frequently found to be the culprit, but in adults norovirus is more common. All such organisms are contagious, being transmitted by the faeco-oral route and also by vomiting. Rotavirus is the leading

cause of severe diarrhoea in infants and young children worldwide. Rotavirus causes severe watery diarrhoea, often with vomiting, fever and abdominal pain; in babies and young children, it can lead to dehydration.

Contamination of spas and whirlpools can lead to infection by *Legionella*, *Pseudomonas aeruginosa* and non-tuberculous mycobacteria. Otitis externa and infections of the urinary tract, respiratory tract, wounds and cornea have also been linked to spas.

Swimming or paddling in water in the developing world may lead to schistosomiasis or other infections such as leptospirosis. Other hazards may include cholera, cryptosporidiosis, giardiasis, hepatitis A and E, legionellosis, leptospirosis, listeriosis and typhoid fever. Direct person-to-person contact or physical contact with contaminated surfaces in the vicinity of swimming pools and spas anywhere may spread the viruses that cause molluscum contagiosum and warts (human papillomaviruses), and fungal infections of the hair, fingernails and skin, especially tinea pedis (athlete's foot).

### Other issues

See Chapter 21 for other infections.

Illness can also be caused by biological toxins found in seafood, which may be paralytic, neurotoxic or amnesic (e.g. shellfish; ciguatera toxin; scombroid or puffer fish). 'Red tides' are harmful algal blooms in water that result in the production of potentially lethal neurotoxic brevetoxins, mainly domoic acid and saxitoxins. Brevetoxins cause neurotoxic shellfish poisoning (NSP); domoic acid is a neurotoxin that causes amnesic shellfish poisoning (ASP); and saxitoxin causes paralytic shellfish poisoning (PSP).

### DISEASES TRANSMITTED FROM SOIL

Soil-transmitted diseases include those caused by spores, such as anthrax, tetanus and deep mycoses. Some intestinal parasites, such as ascariasis and trichuriasis, are transmitted via soil and infections may result from consumption of soil-contaminated vegetables.

### ZOONOSES (DISEASES TRANSMITTED FROM ANIMALS)

A zoonosis is an infection seen in wild or domestic animals that can be transmitted to humans. Infections can be caused by bacteria, viruses, fungi, prions or parasites, which include protozoa and helminths. A partial list of animals that can carry infectious organisms that may be zoonotic is shown in [Box 33.4](#). Rats can, for example, transmit rat-bite fever – infection by bacteria (*Streptobacillus moniliformis* [Haverhill fever] or *Spirillum minus* [sodoku]) – and a wide range of other diseases ranging from typhus to leptospirosis.

Zoonoses include a wide range of infections (such as malaria, dengue fever, Chagas disease, rabies, brucellosis, leptospirosis and certain viral haemorrhagic fevers), which can be transmitted to humans through animal bites or from parasites such as fleas or ticks; via contact with contaminated body fluids or faeces from animals; or by consumption of foods of animal origin, particularly meat and milk products. A partial list of important zoonoses is shown in [Box 33.5](#).

Glanders and SARS (possibly, civet cats may spread the disease, or may catch the disease from humans) might also be zoonoses.

The risk of infection can be reduced by avoiding close contact with any insects or animals – including wild, captive and domestic animals – in places where infection is likely to be present. Pets are no exception and, apart from the dangers from bites (Ch. 24), various infections can

#### Box 33.4 Main animals apart from humans that can transmit zoonoses

- Bats
- Birds
- Cats
- Cattle
- Chickens
- Chimpanzees
- Dogs
- Ducks
- Fish
- Fleas
- Geese
- Goats
- Hamsters
- Horses
- Insects
- Monkeys
- Opossums
- Pigs
- Rabbits and hares
- Raccoons
- Rats
- Rodents
- Sheep
- Sloths
- Snails

be contracted. Particular care should be taken to prevent children from approaching and handling any animals.

### INFESTATIONS

See also Chapter 21.

#### Fleas

##### General aspects and clinical features

Fleas are parasites of humans and other animals, and are transmitted to those in close proximity. They live mainly on the hairy parts of the body, depositing eggs that can cause an itchy rash. Rodent fleas in particular can act as vectors of life-threatening infections, such as typhus (*Rickettsia prowazekii*; Ch. 21) and plague (*Yersinia pestis*), and have been responsible for recent outbreaks of plague in India and other areas.

##### General management

Improved hygiene and malathion are indicated.

#### Lice

##### General aspects and clinical features

Lice infestations, which are increasing in many areas, especially in vagrants, can be of three main types:

- Head lice (*Pediculus humanus* var. *capitis*) infest hair and are particularly common in schoolchildren.
- *Pediculus corporis* infests the body and clothes.



**Box 33.5 Zoonoses**

- Anthrax
- Avian influenza (bird flu)
- Bolivian haemorrhagic fever
- Borreliosis (Lyme disease and others)
- Borna virus infection
- Bovine tuberculosis
- Brucellosis
- Campylobacteriosis
- Chagas disease
- Creutzfeldt–Jakob disease (variant CJD)
- Crimean–Congo haemorrhagic fever
- Cryptosporidiosis
- Cutaneous larva migrans
- Dengue fever
- Ebola virus infection
- Echinococcosis
- Hantavirus infection
- Hendra virus infection
- Henipavirus infection
- Korean haemorrhagic fever
- Lábrea fever
- Lassa fever
- Leishmaniasis
- Leptospirosis
- Listeriosis
- Lyme disease
- Lymphocytic choriomeningitis virus
- Malaria
- Marburg virus infection
- Monkey B virus
- Nipah virus
- Ocular larva migrans
- Orf
- Ornithosis (psittacosis)
- Oropouche fever
- Plague
- Psittacosis ('parrot fever')
- Q fever
- Rabies
- Rift Valley fever
- Ringworms (*Tinea canis*, mainly)
- Salmonellosis
- Sodoku
- Swine flu
- Toxoplasmosis
- Trichinosis
- Tuberculosis (badgers, cows, elephants)
- Tularaemia ('rabbit fever')
- Typhus and other rickettsial diseases
- Venezuelan haemorrhagic fever
- Visceral larva migrans
- Yellow fever

- *Phthirus pubis* (crab lice) infests the pubic hair area and is sexually transmitted.

Lice are transmitted by close contact or via discarded clothing and feed off the host's blood; the puncture wounds can become itchy and bleed. Lice can also, under appropriate circumstances,

transmit diseases such as typhus (*Rickettsia prowazekii*), relapsing fever (*Borrelia recurrentis*) and trench fever (*R. quintana*; Ch. 21).

**General management**

Treatment of lice infestation is with improved hygiene and the use of malathion and carbaryl.

**Bedbugs**

Bedbugs (*Cimex lectularius*) are small insects that live in cracks and crevices around some beds. Attracted by body heat and carbon dioxide, they bite exposed skin and feed on blood. There has been an explosion in bedbug infestations around the world, particularly in America. Increasing tourism and a growing resistance to insecticides are to blame. Bedbugs feed on blood to mature, but they are resilient and can survive for up to a year without feeding. They can also be found in other furniture, carpets and elsewhere, and spread easily from room to room, not by flying or jumping but by crawling. They can soon invade blocks of flats, hotels, hospitals or other buildings. The bugs can be transported in luggage, clothing, furniture and bedding. Bedbugs do not transmit human diseases. Skin reactions to bedbug bites are typically pruritic red bites, often in straight lines; they appear after 1–9 days, usually on the face, neck, hands or arms.

Treatment is to:

- wash infected materials at 60° or clean in a dryer on a hot setting for 30 minutes to kill the bugs
- dismantle bed and furniture and inspect every seam, crevice and joint
- vacuum to remove any bugs
- use insecticide spray specially designed for bedbugs; ordinary insect repellent for mosquitoes and ticks does not seem to be effective
- throw away a mattress if it appears to be heavily infested.

**Ticks****General aspects and clinical features**

Ticks are parasitic on various animals (Table 33.4) and have the following characteristics:

- They are arachnids, relatives of spiders.
- They live in wooded areas mainly.
- They survive by eating host blood.
- They can transmit infections from one host to the next, including humans.

Diseases that can be transmitted to humans include the following:

- 364D rickettsiosis (*Rickettsia phillipi*) is transmitted to humans by the US Pacific Coast tick (*Dermacentor occidentalis*).
- Anaplasmosis is transmitted to humans by the black-legged tick (*Ixodes scapularis*) in the north-eastern and upper mid-western USA, and by the western black-legged tick (*Ixodes pacificus*) along the Pacific coast.
- Babesiosis is caused by parasites that infect erythrocytes. In most cases, *Babesia microti* is transmitted by the black-legged tick (*I. scapularis*) and is found primarily in the north-east and upper mid-western USA.
- Crimean–Congo haemorrhagic fever is found in Eastern Europe, particularly in the former Soviet Union, and in north-western

Table 33.4 Tick-borne diseases of humans

Human disease	Microorganism	Main tick implicated	Main host	Clinical features	Treatment: remove tick and use
Babesiosis	<i>Babesia microti</i>	<i>Ixodes scapularis</i>	Mice	Malaria-like illness. Fatal in elderly or asplenia	Quinine Clindamycin Atovaquone Azithromycin
Colorado tick fever	Coltivirus	<i>Dermacentor andersoni</i> or <i>D. variabilis</i>	Deer Dog	Acute high fever	Tetracycline
Human monocyte ehrlichiosis	<i>Ehrlichia chaffeensis</i>	<i>Amblyomma americanum</i>	Deer	Fever, myalgia, leukopenia, malaise, nausea	Doxycycline
Human granulocyte ehrlichiosis	<i>Anaplasma phagocytophila</i>	<i>I. scapularis</i>	Deer Mice	Fever, myalgia, leukopenia, malaise, nausea	Doxycycline
Lyme disease	<i>Borrelia burgdorferi</i>	<i>I. scapularis</i>	Deer	Rash, arthropathy, neuropathy	Tetracyclines, penicillins, cephalosporins
Powassan virus	Powassan virus	<i>Ixodes</i> spp.	Foxes, skunks, racoons	Encephalitis	–
Relapsing fever	<i>Borrelia</i> spp.	<i>Ornithodoros</i> spp.	Rodents	Fever	Tetracycline
Spotted fever (many different types worldwide)	<i>Rickettsia rickettsiae</i> in USA (Rocky mountain spotted fever), other species worldwide	<i>D. andersoni</i> or <i>D. variabilis</i> in USA	Deer Dog	Fever, myalgia, rash, malaise, nausea  Severe disease in glucose-6-phosphate dehydrogenase (G6PD) deficiency	Tetracycline
Tick paralysis	No organism – tick toxin only	<i>D. andersoni</i>	Dog	Paralysis, including facial, leading to respiratory paralysis	–
Tularaemia, or rabbit fever	<i>Francisella tularensis</i>	<i>A. americanum</i> , <i>D. andersoni</i> or <i>D. variabilis</i>	Rabbit Dog	Ulcer, lymphadenopathy, fever	Streptomycin, gentamicin

China, Central Asia, southern Europe, Africa, the Middle East and the Indian subcontinent.

- Ehrlichiosis is transmitted to humans by the lone star tick (*Amblyomma americanum*), found primarily in the south–central and eastern USA.
- Imported tick-borne spotted fevers (rickettsial infections) have caused infection in returning travellers. In the USA, the culprit is usually *Rickettsia africae* (the agent of African spotted fever).
- Lyme disease can be caused by several different species of *Borrelia burgdorferi*. It is transmitted by the black-legged tick (*I. scapularis*) in the north-eastern and upper mid-western USA, and by the western black-legged tick (*I. pacificus*) along the Pacific coast.
- *Rickettsia parkeri* causes a rickettsiosis that is transmitted to humans by the Gulf Coast tick (*Amblyomma maculatum*).
- Rocky Mountain spotted fever (RMSF) is transmitted by the American dog tick (*Dermacentor variabilis*), Rocky Mountain wood tick (*Dermacentor andersoni*) and the brown dog tick (*Rhipicephalus sanguineus*) in the USA. The brown dog tick and other tick species are associated with RMSF in Central and South America.
- Southern tick-associated rash illness (STARI) transmitted via bites from the lone star tick (*A. americanum*), found in the south-eastern and eastern USA.
- Tick-borne encephalitis (TBE) is caused by three virus subtypes: European or western tick-borne encephalitis virus, Siberian tick-borne encephalitis virus and Far eastern tick-borne encephalitis virus (formerly Russian spring/summer encephalitis virus).
- Tick-borne relapsing fever (TBRF) is transmitted to humans through the bite of infected soft ticks.
- Tularaemia is transmitted to humans by the dog tick (*D. variabilis*), the wood tick (*D. andersoni*), and the lone star tick (*A. americanum*).

### General management

Prevention is by wearing long trousers and long-sleeved shirts in rural areas.

### SPIDERS

In the UK, spiders are not normally hazardous to health but a dozen or more species are capable of causing a significant bite. There are more hazards in the developing world, and even in some high-income countries. Some produce neurotoxins and other poisons, and so should be avoided.

More information is available at: <http://www.nhm.ac.uk/nature-online/life/insects-spiders/identification-guides-and-keys/spider-bites/>, <http://www.findaspider.org.au/info/hazards.htm> and <http://www.cdc.gov/niosh/topics/spiders/> (accessed 30 September 2013).

### SNAKES

Not all snakes are poisonous but some are, and some bites are lethal. Remember that snakes may be swimming in water, as well as hiding under objects. If you see a snake, back away slowly and never touch it.

Signs and symptoms of snakebite may include:

- a pair of puncture marks
- redness and swelling around the bite
- severe pain
- nausea and vomiting
- laboured breathing
- disturbed vision
- increased salivation and sweating
- numbness or tingling around face and/or limbs.

If a person is bitten, try to see and remember the colour and shape of the snake, and:

- keep the bitten person still in order to slow the venom spread
- seek medical attention
- apply first aid:
  - Lay or sit the person down with the bite below the heart level
  - Tell them to stay calm and still
  - Cover the bite with a clean, dry dressing.

Do not interfere in any way with the bite, or let the victim drink alcohol or caffeine.

More information is available at: <http://www.bt.cdc.gov/disasters/pdf/snakebite.pdf> (accessed 30 September 2013).

## TRAVEL PRECAUTIONS

Comprehensive travel and medical insurance should be obtained before travelling, checking any exclusions and cover for all intended activities.

### Before travelling

Since trauma is the greatest danger, travellers should always avoid areas of conflict, violence or natural disasters. Before travel it is advisable to consult: <https://www.gov.uk/foreign-travel-advice> (accessed 30 September 2013). Infections such as malaria, dengue fever or MERV or H5N7 may need to be considered in the potential traveller's risk-benefit analysis.

Travellers should also consult a travel medicine clinic or medical practitioner at least 4–6 weeks before the journey, particularly if vaccinations or antimalarials may be required, or if they intend to visit a developing country, especially if they intend to be in rural areas for prolonged periods (Box 33.6). Awareness of risk is important and precautionary behaviour indicated. For example, hepatitis, yellow fever, cholera and typhoid immunisation may be prudent or essential before visits to the tropics. Meningitis vaccination may be indicated before hajj or similar gatherings (see Mass Gathering Medicine).

Infants and young children, pregnant women, older people, the disabled and those who have pre-existing health problems may need to take special precautions.

### While travelling

Preventing contact with disease-producing organisms is best achieved by: avoiding their habitat (e.g. swamps, jungles); avoiding contact with animals; using barrier precautions (e.g. wearing long sleeves and trousers); avoiding insect bites (e.g. using insect repellents); avoiding exposure to animal excreta; and maintaining high levels of food, water and personal hygiene. Do not consume food that could be contaminated; this is best achieved by drinking and using bottled water, and by eating freshly cooked meat or fish. Use of chlorine and other disinfectants controls most viruses and bacteria in water, though parasites such as *Giardia* and *Cryptosporidium* are highly resistant to routine disinfection; they are, however, inactivated by ozone or eliminated by filtration. Antimicrobial prophylaxis against diarrhoeal disease is not recommended; precautions are shown in Box 33.7.

Avoid direct contact with blood and body fluids by not using potentially contaminated needles and syringes for injection or any other medical or cosmetic procedure that penetrates the skin (including acupuncture, body piercing and tattooing), and by avoiding transfusion of unsafe blood.

### Box 33.6 Vaccines for travellers

#### Routine vaccination

- Diphtheria/tetanus/pertussis (DTP)
- *Haemophilus influenzae* type b (Hib)
- Hepatitis B (HBV)
- Measles (measles/mumps/rubella; MMR)
- Poliomyelitis (oral or inactivated poliomyelitis vaccine [OPV or IPV])

#### Mandatory vaccination

- Meningococcal meningitis (for Hajj, Umra)
- Yellow fever (certain countries)

#### Selective use<sup>a</sup>

- Cholera
- Hepatitis A (HAV)
- Influenza
- Japanese B encephalitis
- Lyme disease
- Meningococcal meningitis
- Pneumococcal disease
- Rabies
- Tick-borne encephalitis
- Tuberculosis (bacilli Calmette–Guérin; BCG)
- Typhoid fever
- Yellow fever

<sup>a</sup>Check for country to be visited.

### Box 33.7 Prophylaxis against diarrhoeal disease

#### Eat

- Only food that has been cooked thoroughly and is still hot

#### Boil

- Unpasteurized (raw) milk before consumption
- Drinking water, if its safety is doubtful; a certified, well-maintained filter and/or a disinfectant agent can also be used

#### Avoid

- Cooked food kept at room temperature for several hours
- Uncooked food, apart from fruit and vegetables that can be peeled or shelled
- Fruits with damaged skins
- Dishes containing raw or undercooked eggs
- Food or ice cream bought from street vendors
- Ice, unless it has been made from safe water
- Brushing teeth with unsafe water; bottled or packaged cold drinks are usually safe, provided that they are sealed
- Contaminated recreational water, particularly sewage-polluted sea water or fresh water in lakes and rivers, as well as water in swimming pools and spas

### On return

On return, travellers should have a medical examination if they: suffer from a chronic illness, such as cardiovascular disease, diabetes mellitus or chronic respiratory disease; experience illness, particularly fever, persistent diarrhoea, vomiting, jaundice, urinary disorders, skin disease or genital infection; consider that they have been exposed to a serious infectious disease; or have spent more than 3 months in a developing country.

## MASS GATHERING MEDICINE

Mass gatherings are occasions such as sports events, music festivals or religious celebrations that attract a large number of people: for example, the annual Muslim Hajj pilgrimage to Saudi Arabia and Mecca, or the Hindu Magh Mela in India and Allahabad. Mass gatherings may be defined as public events attended by in excess of 1000–25000 people. Such events can give rise to disasters such as stampedes with physical injuries and deaths, and to eventualities ranging from infectious disease outbreaks to terrorist attacks – with implications beyond the scope of typical public health provision. Factors influencing demand for the health care at mass gatherings may include:

- alcohol/drugs
- crowd containment (fenced/contained or not)
- crowd density
- crowd movement
- event duration
- communicable disease spread
- weather.

See Chapter 21.

## PETS

Bites, scratches and infections are discussed above and in Chapters 21 and 24.

## KEY WEBSITES

(Accessed 8 July 2013)

Centers for Disease Control and Prevention. <<http://wwwnc.cdc.gov/travel/>>. GOV.UK. Foreign travel advice. <<https://www.gov.uk/foreign-travel-advice>>. National Institute of Arthritis and Musculoskeletal and Skin Diseases. <[http://www.niams.nih.gov/health\\_info/sports\\_injuries/](http://www.niams.nih.gov/health_info/sports_injuries/)>. <[http://www.who.int/csr/mass\\_gatherings/en/](http://www.who.int/csr/mass_gatherings/en/)>.

## USEFUL WEBSITES

(Accessed 11 June 2013)

British Association of Sport & Exercise Medicine. <<http://www.basem.co.uk/>>. Medscape Reference. <<http://www.emedicine.com/sports/index.shtml>>. Peak Performance. <<http://www.pponline.co.uk/>>. Sports Medicine Online. <<http://www.sportsmedicine.com/>>. Travax. <<http://www.travax.nhs.uk>>.

Travel Doctor. <<http://www.traveldoctor.co.uk>>.

UK Sport. <<http://www.ukssport.gov.uk>>.

World Anti-Doping Code (under 'International Standards/Prohibited List'). <<http://www.wada-ama.org/en/World-Anti-Doping-Program/>>.

World Health Organization: Disease Outbreak News (DONs). <<http://www.who.int/csr/don/en>>.

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