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ESSENTIALS Tourists, business people, pilgrims, and visitors to friends and relatives are making increasing numbers of trips to tropical and developing parts of the world, where the risk and range of infectious and envir- onmental diseases and injuries may be much higher than in Western countries. The aim of travel and expedition medicine is to reduce risk through education, appropriate immunizations, and other medical advice, hence enhancing the enjoyment and achievements of trav- elling abroad. Explorers, expeditioners, and wilderness travellers face the greatest health challenges, but risk can be minimized by technical competence, careful planning, training in practical medical skills, and rehearsing emergency evacuation. Pretravel advice—this requires precise information about the mode of travel, geographical itinerary, and the purpose of the visit, and must take into account the age, background health, and immunocom- petence of the traveller. Important provisions are (1) a first-aid kit, (2) sun-block, (3) insect repellent, (4) treatments for motion sickness, jet lag and high altitude sickness, (5) supplies of regular medications for chronic medical conditions, and (6) generous, comprehensive travel insurance. Pretravel immunization—this involves (1) boosting childhood vac- cinations (e.g. tetanus, poliomyelitis, and diphtheria); (2) adding pro- tection against hepatitis A (and B in those at risk of parenteral or sexual exposure) and infections endemic in the areas to be visited (e.g. yellow fever in equatorial Africa and South America, Japanese encephalitis in Southeast Asia, tick-borne encephalitis in northern Europe and Asia, Neisseria meningitidis in the meningitis belt of Africa, typhoid in South Asia, and rabies in most parts of the world). Pregnancy and immunodeficiency present particular problems of vulnerability to infections and restrict the use of live vaccines. Reducing the risk of infections—food and water hygiene are crucial for prevention of travellers' diarrhoea, the most common medical problem likely to be encountered. Avoidance of bites by disease vectors such as mosquitoes and ticks and use of appropriate prophylactic drugs reduces the risk of malaria and many other trop- ical infections. The risks of emerging infectious diseases such as avian influ- enza, Middle East respiratory syndrome coronavirus (MERS-CoV), and Ebola need to be understood and managed. Recent years have seen the emergence of medical tourism, where people travel to an- other country to undergo surgical or medical treatment, and this has been associated with the acquisition of multidrug resistant bacteria. Underestimated hazards of

travel include sexually transmitted infec- tions, psychiatric illness, drowning, and road traffic accidents. Introduction International tourism has grown prodigiously over the last few years. In 2014 international tourist arrivals exceeded 1.1 bil- lion, and this number is predicted to be 1.8 billion by 2030. Approximately 30% were to tropical or subtropical developing countries. United Kingdom citizens make 60 million visits abroad each year, 8% of these to developing countries which carry a higher risk of illness (600-fold increased risk in Mexico, 1835-fold in the Indian subcontinent) than travel to European countries such as France. It has been estimated that 50–75% of short-term trav- ellers to tropical or subtropical countries become unwell, usually because of an infection. Those travelling outside Europe need to be provided with adequate medical advice to minimize the risks of their journeys, while back at home, admitting physicians should consider a broader range of differential diagnoses, diagnostic tests, and specific treatments. Among the more common infectious dis- ease health risks faced by travellers to developing countries are traveller's diarrhoea, malaria, dengue fever, acute lower respiratory tract infection, hepatitis A, gonorrhoea, and animal bites with ra- bies risk (Table 8.4.1). Pretravel advice This can be obtained from a variety of sources, but ideally should be sought from medical practitioners and clinics with a special interest in travel medicine. Other sources include the embassies of the countries to be visited, travel agencies, and, increasingly, the internet (see 'Further reading'). People travel for a variety of reasons: business travel, pilgrimage, gap-year and educational travel, and tourism are all increasing. Many members of the immi- grant communities of Western countries travel to visit their friends 8.4 Travel and expedition medicine Susanna Dunachie and Christopher P. Conlon

 and relatives abroad; these travellers are less likely to seek pretravel advice, but may be more vulnerable to endemic diseases in the tropics because of the living conditions at their destination. At the pretravel clinic, the clinician elicits details about the pro- posed journey and the individual traveller's previous health and requirements. Such discussions allow a proper risk assessment to be made, so that advice and immunizations can be appropriately tailored. Issues that should be considered include general health ad- vice, an assessment of the problems posed by different climates or environments, and the route, type, and duration of travel. Specific advice will include details of the necessary immunizations, and pro- tection against malaria and other relevant diseases. It is important to discuss what might be done if the traveller were to fall ill while abroad or become unwell after their return. Travellers should be encouraged to take out generous and specific travel and health in- surance, including cost of repatriation in case of serious illness or accident. General advice about health First-aid kit Travellers should carry a basic first-aid kit that should include anti- septic solution/wipes; bandages; plasters; proprietary drugs for pain relief, diarrhoea, constipation, dyspepsia, allergy, and itch; sun- screen preparations; water purification tablets; and insect repellents. Motion sickness Antiemetic drugs such as cyclizine or hyoscine are effective, but they may cause sedation and a dry mouth. Long-acting transdermal skin patches containing scopolamine or antiemetics that can be absorbed through the buccal mucosa are preferable. Air travel and jet lag Long-haul air flights lead to jet lag: sleep disturbance, fatigue, a feeling of light-headedness and unreality, and poor concentration. Table 8.4.1 Immunizations Vaccine Type Route Primary course Booster Routine Combined tetanus, polio, diphtheria, pertussis, and Haemophilus influenzae b DTaP/IPV/Hib IM/SC Three doses at monthly intervals 10 years (maximum 5 total doses) Influenza Killed virus IM Single dose Yearly Pneumococcal 23-valent polysaccharide IM/SC Single dose Repeat in those at high risk Pneumococcal 13-valent conjugate polysaccharide IM/SC Three doses at 2, 4, and 13 months (not licensed for adults) Repeat in those at high risk Measles, Mumps and Rubella (MMR) Live

attenuated virus IM Two doses Meningococcal disease Conjugate ACWY IM Single Every 3–5 years Those previously immunized with polysaccharide vaccines should be boosted with conjugate vaccine Travel Combined diphtheria, tetanus, and polio DTP IM/SC 10 years Hepatitis Aa Killed virus IM Two doses, 6–12 months apart Probably not required Hepatitis B Adsorbed IMb Three doses at 0, 1, and 6 months Single booster at 5 years (may not be required) Japanese B encephalitis Killed virus Vero cell vaccine IM/SC Two doses on days 0, and 28 1–2 years, later boosting uncertain Rabies Killed virus IMb/IDb, c 0.1 ml Three doses on days 0, 7, and 28 Rarely indicated in travellers; consider boost at 10 years Tick-borne encephalitis Killed virus IM Two doses 4 weeks apart, then at 9–12 months Every 3 years Tuberculosis: BCGd Attenuated ID Single dose None Cholera Inactivated O1 strain plus recombinant B toxin subunit PO Two doses 1 week apart 6 months Typhoid Live Ty21a strain (attenuated) PO Three doses on alternate days Every 3 years Typhoida Capsular Vi polysaccharide IM Single dose Every 3 years Yellow fever Live virus (attenuated) SC Single dose Not needed ID, intradermal; IM, intramuscular; PO, oral; SC, subcutaneous. a Combined hepatitis A and typhoid vaccines are available. b Should not be given into the buttock; deltoid or anterior thigh preferred. Double the dose for immunocompromised patients, or those on dialysis. c Efficacy reduced if given with chloroquine antimalarial prophylaxis. d Evidence of efficacy only in children under 5 years of age.

8.4 Travel and expedition medicine 715 These symptoms may be attributable to a hangover if exces- sive alcohol has been drunk on the flight. A short-acting seda- tive, such as zopiclone or zolpadem, taken for the first couple of nights after flying, helps to re-establish a regular sleeping pat- tern. Some travellers have found that melatonin is helpful, but obtaining products with the active ingredient can be a problem. The appropriate timing of exposure to daylight and meals can speed up the adjustment of circadian rhythms. People with dia- betes might need advice on adjusting their insulin regimen or diet for changes in time zones, as might patients taking other regular medications. Modern aircraft ventilation systems have high- quality filtration systems to remove microorganisms and deliver much lower rates of recirculated air than air-conditioned build- ings. However, transmission of air-borne pathogens including the common cold, influenza, and tuberculosis from immediate neighbours can occur. The risk of deep vein thrombosis from pro- longed immobility and dehydration can be reduced by wearing tailored elastic stockings, moving about as much as possible, and frequently drinking water. Regular medications Patients with chronic illnesses such as diabetes, asthma, or HIV should take plenty of their current medications, as these may not be available abroad, and pack vital supplies in hand luggage. Patients should carry a letter from their physician outlining the condition, itemizing the medications to be carried and providing contact details. Food and water hygiene Strict food and water hygiene are important for travellers to coun- tries with relatively poor sanitation. ‘Boil it, peel it, or forget it’ is a useful adage for the traveller, but is sometimes difficult to imple- ment without causing offence when receiving hospitality. Foods to be avoided are raw or rare meat, fish, and other seafood (but see further on in this chapter), food that has been stored unrefrigerated since it was cooked, ‘street food’ unless freshly boiled or fried, un- pasteurized dairy products, cold sauces and dressings, raw salads and vegetables, and unpeeled fruits or even peeled tomatoes. Water purification tablets and many types of portable water filters are avail- able. Beverages made with boiled water are generally safe, whereas bottled water and, especially, ice cubes are unreliable. Treated water should always be used, even for tooth cleaning and washing fruit. Unfortunately, marine toxins are not destroyed by heat and so high- risk seafoods, such as puffer fish, large reef fish, and shellfish gath- ered while there is a ‘red tide’, should be avoided. Viral gastroenteritis (e.g. norovirus) is

transmitted by contamin- ated food and water, person-to person contact, aerosolization, and environmental contamination. Outbreaks frequently occur in con- fined places such as all-inclusive resorts and on cruise ships. Good hand hygiene and avoiding contaminated food, water, and environ- ments reduce the risk of transmission. Climatic and environmental extremes Sun and heat Travellers should be reminded of the risks of sun exposure, and en- couraged to dress and behave appropriately, to use sunscreen, and to wear a hat or other head protection in the sun. They must keep adequately hydrated and be aware of the risk of heatstroke. Several days of relative inactivity are needed to acclimatize safely to hot climates. Swimming Apart from the risk of drowning (Chapter 10.4.4), or being bitten, stung, or attacked by aquatic animals (Chapter 10.1.2), swimmers and bathers can be exposed to waterborne diseases such as schis- tosomiasis and leptospirosis in fresh water, together with the pos- sibility of ingesting water and contracting gastrointestinal illnesses, even in swimming pools. Generally, swimming in chlorinated water is to be preferred. Schistosomiasis (bilharzia) occurs in Africa (including Madagascar), the Middle East, eastern South America, China, and Southeast Asia. Infection is acquired by both bathing and washing with fresh water in lakes and sluggish rivers. Vector-borne diseases Travellers should be warned about the risk of diseases transmitted by the bites of mosquitoes (e.g. malaria, dengue fever, chikungunya, Zika virus, Japanese encephalitis) and ticks (e.g. tick-borne enceph- alitis, Lyme disease, rickettsioses) and advised how to avoid bites. Dengue and chikungunya are transmitted predominantly by Aedes mosquitoes that breed well in urban areas and frequently bite during the day. Both diseases have increased markedly in the past decade and international travel has enhanced their spread. The global distribution of chikungunya has expanded rapidly in recent years, with outbreaks in the Americas and Caribbean since 2013 and in the Pacific since 2014. Smaller outbreaks in South Europe and the southern US states have occurred. A large Zika virus epidemic in South America has been associated with an increased risk of micro- cephaly when women are infected in pregnancy. High altitude At high altitudes, snow blindness and severe sunburn can occur under clear skies, even at very low ambient temperatures. Those going to high altitudes should acclimatize slowly and build up their level of physical activity gradually (see Chapter 10.4.6). They should be aware of the symptoms and signs of altitude sickness. Acetazolamide in an adult dose of 250 mg twice a day, starting 12 h before starting the ascent, is effective prophylaxis for mild mountain sickness, especially if the traveller has to ascend rapidly (e.g. flying from sea level to more than 3000 m). But gradual ascent allowing acclimatization is preferable, and if severe symptoms develop there is no substitute for rapid descent. In the tropics, heat, dehydration, and salt depletion may cause additional problems. Wilderness, game parks, and safaris Careful planning should include provision of navigational aids to avoid getting lost; appropriate clothing, equipment, and vehicle; and adequate food and drink. Wilderness travellers may be exposed to a variety of environmental dangers including unpredictable meteoro- logical extremes, including flash floods and lightning strikes (see Section 10), unfriendly local inhabitants, and attacks by large wild animals. Personal safety and security Travellers should be aware of risks of crime, political instability, and travel safety at their destination. They should keep up to date

 with travel advice from their host country (e.g. https://www.gov.uk/ foreign-travel-advice) and be aware that their travel insurance may be invalid if they travel to regions against the Foreign Office’s advice. If travelling to regions at increased risk of terrorism or civil unrest, keeping in touch with events at their destination through news out- lets and social media is advisable. Road traffic accidents are a leading cause of death and severe in- jury in travellers abroad, and travellers should be advised to assess the safety of a mode of

transport before embarking on a journey. Alcohol and drug use while travelling raise the risk of being a victim of theft or assault and the risk of acquiring sexually transmitted in- fections. Safety standards for activities such as diving and hazardous sports may vary from international standards. Blood-borne and parenteral infections In many developing countries, blood-borne pathogens such as hepatitis B and C viruses, HIV, and, in some areas, malaria, trypano- somiasis, and other infections are prevalent. Screening of donated blood may not be rigorous, and needles may be reused, sometimes without adequate sterilization. As a result, travellers going far off the beaten track should consider taking sterile disposable needles, can- nulas, and syringes. A covering letter from a doctor may allay the suspicion of customs officials that they are to be used for drug abuse. Sexually transmitted infections Surveys indicate that 4 to 20% of travellers have casual sex while abroad, and that these acts are unprotected on 50% of occasions. One result is about seven new cases of HIV per 100 000 travellers per year. For United Kingdom residents, the risk of acquiring HIV is 300 times greater while travelling abroad than at home. Between 14 and 25% of cases of gonorrhoea and syphilis diagnosed in Europe are imported. Travellers are more likely than usual to engage in un- protected sexual activity, especially when disinhibited by alcohol or other recreational drugs. Since sexually transmitted infections, including HIV, are highly prevalent in many holiday resorts (not only in prostitutes), good-quality condoms, often not available when travelling, should be carried and used. Pretravel advice should in- clude a discussion of the risks of unsafe sex. Immunizations Childhood vaccinations The traveller's record of childhood immunizations should be re- viewed (Chapter 8.3). Many adults will require booster doses for tetanus, polio, and diphtheria and may not have been adequately immunized against measles or mumps. Over the past few years, outbreaks of mumps and measles have occurred in many coun- tries. Pertussis occurs globally and resurgences of disease in popu- lations have been reported in countries with good vaccine coverage, demonstrating lack of lifelong protection from a primary course. Previous travel immunizations should be noted, so that they are neither repeated unnecessarily, nor allowed to lapse. Hepatitis A The incidence of hepatitis A in developing countries ranges from 6 to 30 cases per 100 000 unprotected travellers per month of stay. Active immunization is safe, effective, and durable. Those who have received a full course of immunization will probably not need any further boosting doses. Hepatitis B This is a risk to medical or laboratory staff whose work involves contact with human blood and to those staying for prolonged periods, such that there is a possibility of receiving unsafe injec- tions or unscreened blood transfusions. Hepatitis B is also a risk of unprotected sexual activity. Vaccination in these circumstances is sensible. Yellow fever This is the only vaccination for which an internationally valid cer- tificate is statutorily required for entry into countries where the dis- ease is endemic, and for travellers from those places. Yellow fever remains endemic in tropical Africa and South America, but not in Asia (see Fig. 8.4.1). There have been reports of adverse events asso- ciated with yellow fever vaccine, particularly in older people. Such reactions may be more common in those with thymic dysfunction or with other types of immune defect. There have also been inter- national shortages of the vaccine. Studies support immunity of at least 35 years being conferred by a single dose of yellow fever vaccine, and in 2014 the World Health Organization (WHO) adopted the recommendation to remove the requirement for a 10-year booster from the International Health Regulations, but up to date certificate requirements for individual countries should be checked from a reliable source such as Public Health England or the Centers for Disease Control and Prevention. Cholera Vaccination is no longer required by international regulations. Earlier vaccines were of little use, and although there is now a li- censed oral vaccine, it is really only necessary for those, like aid workers in refugee camps, who have a high risk of exposure. Typhoid This potentially

serious infection remains prevalent in Pakistan, India, Bangladesh, Indonesia, and Nepal, where the incidence of infection is approximately 1 in 3000 per month of stay. Those staying for long periods in rural areas, and especially those visiting friends and relatives abroad, are at greatest need of vaccination. Meningococcal disease In the meningitis belt of sub-Saharan Africa, from Senegal to Sudan, and in some other areas, cool, dry-season meningococcal meningitis outbreaks are so predictable that immunization is re- commended for travellers living or working closely with local people. The quadrivalent meningococcal vaccine (covering sero- groups A, C, W135, and Y) is recommended. The ACWY conju- gate meningococcal vaccine has proved safe and immunogenic in all age groups, including infants. The quantity and quality of the antibody response is superior to that produced by polysaccharide vaccines and their use reduces meningococcal carriage, reducing transmission. Following outbreaks associated with the Hajj over the past few years, pilgrims to Mecca are required to be immunized and provide proof.

8.4 Travel and expedition medicine 717 Rabies Pre-exposure rabies vaccination is being used increasingly (see Chapter 8.5.10). Although the risk of transmission is fairly low, the lack of effective treatment for rabies encephalitis, and the fear en- gendered by bites by dogs, and in many parts of the world by bat bites, justifies considering immunization. Prophylactic vaccination does not remove the need for postexposure treatment if a poten- tially rabid bite is received, but it simplifies the treatment and usually avoids needing postexposure rabies immune globulin which is un- available in many endemic tourist destinations. Fig. 8.4.1 Yellow fever vaccination recommendations for (a) Africa and (b) South America from http://www.nathnac. org/pro/factsheets/yellow.htm and WHO (2011) http://www.who.int/ith/en/ WHO (2011) http://www.who.int/ith/en/

718 SECTION 8 Infectious diseases Other encephalitides Vaccination against Japanese encephalitis and tick-borne encephal- itis may be considered after reviewing the travel itinerary and risk of exposure (Table 8.4.1). A new Vero cell-derived vaccine against Japanese encephalitis (IXIARO) was licensed in 2009. Prevention of malaria Both travellers and nonspecialist physicians must be educated about the prevention and recognition of malaria (see Chapter 8.8.2). It is important to be aware of the need to prevent mosquito bites by all possible means: wearing appropriate clothing, application of insect repellents to exposed skin and clothing, and the use of insecticide-impregnated bed nets and insecticide sprays or vaporizers in the sleeping quarters. UK residents who were born in malaria-endemic regions and return to visit friends and family at particular risk be- cause they may not appreciate that any naturally acquired immunity has waned. Guidelines for antimalarial chemoprophylaxis are regularly up- dated (see ‘Further reading’, Websites) and for travel to areas where the risk of malaria, although finite, is low, standby antimalarial treat- ment rather than prophylaxis is increasingly recommended. In areas of low incidence (fewer than 10 cases of malaria per 1000 of the local population per year) such as Central America and Southeast Asia, the risk of taking antimalarial drugs outweighs the risk of infection and so reliance is placed on antimosquito measures and carrying a course of standby emergency treatment if the traveller develops symptoms suggestive of malaria while out of reach of medical care. Travellers should be educated about the risks of fake and ineffective drugs for malaria for sale in some endemic regions. Prevention and management of travellers’ diarrhoea Diarrhoea is the most common health problem of travellers. Symptoms are usually mild, lasting only about 3–5 days, but holiday and business plans may be disrupted (Box 8.4.1). The most common cause is enterotoxigenic Escherichia coli (ETEC). Salmonella spp., Campylobacter spp., Shigella spp., and other patho- genic

E. coli are also common. Protozoan pathogens, such as Giardia intestinalis, Entamoeba histolytica, Cryptosporidium parvum, and Cyclospora cayetanensis are less common causes. Viruses, particularly norovirus and rotavirus, are increasingly recognized causes of travellers' diarrhoea in adults. Fish and shellfish poisoning cause similar symptoms to each other, starting within minutes or hours of exposure. Strict food and water hygiene reduce the risk of gastroenteritis. Heating water to 100 °C will kill most pathogens, as will chemical treatment with chlorine or iodine (iodine is contraindicated in pregnant women and some patients with thyroid disease). Water filters are also effective. Antimicrobials such as fluoroquinolones, azithromycin (for fluoroquinolone-resistant campylobacter in South and South-East Asia) or rifaximin, a poorly absorbed rifamycin de- rivative provide some protection, but are not cheap, may cause side effects, cannot be taken for prolonged periods, and may encourage antimicrobial resistance. Colloidal bismuth salts are cheaper, safer, and reasonably effective, but the large volumes are inconvenient. An experimental transcutaneous heat-labile enterotoxin vaccine reduced the frequency and severity of travellers' diarrhoea but oral killed Vibrio cholerae vaccine had little effect despite inducing crossimmunity to ETEC. Treatment involves maintaining an adequate fluid intake and using sachets of oral rehydration salts that can be made up with boiled water. Eating solid food may stimulate bowel action by the gastrocolic reflex. Antidiarrhoeal agents such as codeine phosphate and loperamide often relieve symptoms sufficiently to allow normal activities to continue. Short courses of empirical antimicrobials (e.g. ciprofloxacin, 500 mg for 3 days, adults only), azithromycin, or rifaximin can be useful, particularly for patients with underlying diseases. Combination of an antimicrobial, such as rifaximin, with loperamide has proved more effective symptomatically. Localized abdominal pain, high fever, and bloody diarrhoea are indications for seeking medical help immediately. Special groups of travellers Immunocompromised travellers Except for asplenic patients, immunocompromised travellers—including those who have recently received chemotherapy or radiotherapy—should not be given live vaccines such as yellow fever, oral polio, and oral typhoid. Killed or synthetic vaccines are safe. Those patients with mild to moderate immune suppression will probably make a reasonable response to immunization; those with more severe immunosuppression may still make a useful, though less durable, response. Influenza, pneumococcal, and Haemophilus influenzae b conjugate vaccines are recommended, as these patients' Box 8.4.1 Some causes of travellers' diarrhoea Bacteria Enterotoxigenic and enteroaggregative Escherichia coli (c.15–80%) Aeromonas spp., Plesiomonas spp. Campylobacter jejuni Salmonella typhi Other Salmonella spp. Shigella spp. Vibrio parahaemolyticus Clostridium difficile Protozoa Cryptosporidium parvum Cyclospora cayetanensis Entamoeba histolytica Giardia intestinalis Plasmodium falciparum Other Rotavirus/norovirus Schistosoma mansoni Strongyloides stercoralis Irritable and inflammatory bowel disease Tropical sprue Food allergy Drug side effects, Fish/shellfish toxins

 risk of respiratory infection and bacteraemia is increased. Studies show that immunosuppressed patients can make a response to hepa- titis A immunizations, although the durability of this response is again uncertain. People with HIV will often make a good response if they are on antiretroviral medication and have made a good CD4 count. Asplenic individuals should be on prophylactic antibiotics, such as amoxicillin, particularly if travelling, and should be dis- suaded from travelling to areas with high rates of malaria transmission, as they are more likely to get severe disease if infected. Immunocompromised patients should carry antimicrobials with them for treating respiratory or gastrointestinal infections, should seek medical help when abroad, and should carry a letter from their physician outlining their condition and medication. Pregnant travellers Commercial airlines will not normally convey a

woman who is 36 weeks or more pregnant, without a covering letter from her midwife or physician. Insurance to cover the cost of delivery abroad should be considered. If possible, pregnant women should avoid travelling to areas where diseases are prevalent that pose a special risk in their condition, such as malaria and hepatitis E. The risk–benefit assessment of immunizations and chemo- prophylaxis is of particular importance for the pregnant woman and the fetus. Live vaccines should be avoided, but if there is a genuine risk of yellow fever the vaccine should be given, as there is no rec- ognized associated teratogenicity. Inactivated polio vaccine may be given parenterally, and tetanus immunization is safe. The old heat- killed whole cell vaccine should be avoided but the modern polysac- charide capsular Vi vaccine is safe. Pneumococcal, meningococcal, and hepatitis B vaccines are safe in pregnancy, as is γ-globulin. Malaria is especially dangerous in pregnant women. Chloroquine and proguanil are safe prophylactic drugs, and quinine in normal therapeutic doses is safe for treatment. Artemisinin derivatives are not known to be safe in the first trimester. Atovaquone-proguanil and doxycycline are not recommended in pregnancy. A study of mefloquine in pregnancy (predominantly first trimester) showed no difference in birth defects compared to controls, but many would still advise caution in the first trimester of pregnancy. Pregnant women should take special care with food and drink when abroad, as dehydration may threaten the fetus. There are concerns about congenital goitre when pregnant women use iodine to purify water; the maximum recommended daily intake is 175 µg. Loperamide as an antidiarrhoeal agent is safe, but antimicrobials such as tetracyc- lines and quinolones should be avoided. Extremes of age Young children should have completed their routine immuniza- tions before travelling if possible. Malaria chemoprophylaxis is re- commended for all ages. Yellow fever vaccine should be given only to children older than 9 months, as a few cases of vaccine-associated encephalitis have occurred in younger children. Most other vaccines, including rabies, are safe. Hepatitis A is rarely symptomatic in children under 5 years old. Families planning to live in developing countries should consider Bacille Calmette–Guérin (BCG) vaccination for chil- dren under 5 years of age to reduce the risk of tuberculous meningitis. Older people should have the same immunizations as younger adults, and should take antimalarial drugs. They are more prone to respiratory infections, and should therefore be given influenza, pneumococcal, and Haemophilus influenzae vaccines. Jet lag and changes in time zones may be very disturbing. Older people are more likely to have an underlying medical condition requiring medication. It is important that sufficient supplies of medicines are taken abroad and that the patient has a detailed list of these medi- cines and their dosages in case the tablets are lost or stolen. They should carry the name and contact address of their home physician, in case of emergency. Hajj pilgrimage Every year more than two million Muslim people from almost 200 countries undertake pilgrimage to Mecca, Saudi Arabia, making it the world’s largest mass gathering. Some travellers will be eld- erly and/or immunocompromised. Travellers must show a valid International Certificate of Vaccination with the quadrivalent meningococcal vaccine. Children under 15 years of age must also submit proof of polio vaccination. Up-to-date requirements are outlined on the webpage of the Saudi Arabian embassy: http:// wwwnc.cdc.gov/travel/yellowbook/2016/select-destinations/ saudi-arabia-hajj-pilgrimage. The most common cause of illness in Hajj pilgrims is pneu- monia, and vaccination against influenza is advised alongside pneumococcal vaccine for at-risk groups. Middle East respiratory syndrome coronavirus (MERS-CoV) was first identified in Saudi Arabia in 2012, with a possible role of camels in disease transmis- sion. Travellers should be advised to avoid contact with camel prod- ucts and to practise good hand and respiratory hygiene to reduce the risk of respiratory illnesses. Other risks for Hajj pilgrims include heat exhaustion and the risk of crush injury in stampedes due to overcrowding. Explorers and expeditions Because of their adventurous

aims, expeditions are likely to involve exposure to greater environmental extremes and hazards than or- dinary travel. Expeditions usually take place in areas remote from even rural health centres, and so a greater responsibility for dealing with medical problems will devolve to the expedition members. The explorer's greatest fear may be to fall victim to a lethal tropical dis- ease or an attack by a wild animal, but the reality is much more mun- dane: road traffic accidents, mountaineering disasters, drowning, and attacks by humans claim the most lives. The prevention and treatment of medical problems must be planned well in advance. Detailed advice and information can be obtained from several organizations, such as the Expedition Advisory Centre (Geography Outdoors) of the Royal Geographical Society in London, from clubs specializing in mountaineering, cave exploring, diving, and other activities, and from books, journals, and websites. All expeditions should have a designated medical officer, and all their members should receive first-aid training aimed at the par- ticular needs of the expedition. The basics are clearing the airway, controlling bleeding, treating shock, relieving pain, and moving the injured person without causing further damage. Expedition medical kits should be more comprehensive than those carried by ordinary tourists and travellers. Lists of essential drugs are given in Johnson et al. (2008) and an adequate water supply must be assured or taken

 if the expedition is into desert areas. The need for further equipment to facilitate rescue such as a collapsible stretcher, and communica- tion systems such as satellite phones must be evaluated. A covering letter on official notepaper, signed by a doctor, may be helpful in allowing drugs, even apparently innocuous ones such as codeine, through customs and explaining the need for needles and syringes. The medical facilities nearest to the site of the exped- ition must be identified and contacted in advance. An emergency plan must be drawn up for the first-aid treatment and evacuation of severely ill or injured expedition members. In some areas, flying doctor and air evacuation services (such as the African Medical and Research Foundation (AMREF) in East Africa) are available. Medical insurance must be generous and comprehensive, and in- clude repatriation of the injured. Before leaving their home country, expedition members should have a thorough dental check and treat- ment for any outstanding medical or surgical problems. Control of chronic medical problems such as diabetes mellitus, hypertension, and asthma should be stabilized. In selecting members for an exped- ition, the most important attributes are experience, possession of the necessary technical skills (e.g. diving and mountaineering), physical fitness, and proven psychological stability under stress. It is advis- able always to appoint a reliable local agent in the country where the expedition will take place, and a home agent in their country of origin to facilitate communication if problems arise.

Illness in returning travellers

Details are needed about the countries visited, the activities under- taken while travelling, immunizations, and antimalarials taken. Common problems are fever, rash, diarrhoea, and eosinophilia (Tables 8.4.2 and 8.4.3, and Box 8.4.2). The most important diagnosis to exclude in a traveller from the tropics with a fever is malaria. In travellers with acute diarrhoea, a dietary history, assessment of hydration state, stool microscopy and culture, abdominal films, and sigmoidoscopy may be needed. There are many possible causes (see Box 8.4.1). Patients with chronic diar- rhoea may be infected with Giardia spp., Cryptosporidium spp., Entamoeba histolytica, shigellae, or salmonellae. Investigations should include a search for Clostridium difficile, especially if the

Table 8.4.2 Causes of fever in returned travellers

Tropical infections	Other infections	Noninfective causes
Short incubation; <3 weeks		
African trypanosomiasis	Pneumonia	Drug reaction
Brucellosis	Prostatitis	Factitious
Chikungunya fever	Dengue fever	Sexually transmitted infection
Inflammatory bowel disease	Haemorrhagic	
Endocarditis	Connective tissue disease	

fevers (e.g. Ebola, Lassa) Sinusitis Malignancy Hepatitis A Urinary tract infection Malaria Influenza Relapsing fevers EBV / CMV Tick/scrub typhus Typhoid Leptospirosis Malaria Middle East respiratory syndrome
coronavirus (MERS-CoV) Melioidosis Long incubation; >3 weeks Amoebic abscess Brucellosis Coccidioidomycosis Filariasis Hepatitis A, B, or C HIV Leishmaniasis Malaria Melioidosis Schistosomiasis (Katayama fever) Tuberculosis Typhoid

8.4 Travel and expedition medicine 721 patient took antimicrobials while abroad. A minority of patients may develop postinfective enteropathy, the most common problem being secondary lactose intolerance. Rarely, bacterial overgrowth or tropical sprue develops. The most common causes of eosinophilia are allergy, drug reac- tions, and helminths (Box 8.4.2). Emerging infectious diseases in returning travellers The 21st century has seen the emergence of new and underrecognized diseases including severe acute respiratory syndrome (SARS), MERS-CoV, Zika virus, and avian influenza. Melioidosis, a Gram- negative sepsis with high case fatality caused by Burkholderia pseudomallei, has presented in travellers returning from a wide dis- tribution of tropical countries alongside hyperendemic regions in Southeast Asia and Northern Australia. The outbreak of Ebola virus in West Africa since 2014 has under- scored the need for physicians to consider viral haemorrhagic fever specifically in travellers returning with a fever from affected areas. Being able to reassure the public and healthcare workers where no significant risk of viral haemorrhagic fever is present is important. Up-to-date information on risk assessment and maps can be found on the Public Health England website: https://www.gov.uk/gov- ernment/collections/viral-haemorrhagic-fevers-epidemiology- characteristics-diagnosis-and-management. FURTHER READING Auerbach PS (ed) (2011). Wilderness medicine, 6th edition. Mosby Elsevier, Philadelphia, PA. Barwick R (2004). History of thymoma and yellow fever vaccination. Lancet, 364, 936. Chen LH, et al. (2011). Vaccination of travelers: how far have we come and where are we going? Expert Rev Vaccines, 10, 1609–20. Chiodini PL, et al. (2015). Guidelines for malaria prevention in travel- lers from the United Kingdom. Public Health England, London. Conlon CP (2001). The immunocompromised traveler. In: DuPont HL, Steffen R (eds) Textbook of travel medicine and health, 2nd edition. BC Becker, London. Dawood R (2012). Travellers' health: how to stay healthy abroad, 5th edition. Oxford University Press, Oxford. Freedman DO, Chen LH, Kozarsky PE (2016). Medical considerations before international travel. N Engl J Med, 375, 247–60. Hill DR, Ford L, Lalloo DG (2006). Oral cholera vaccines: use in clin- ical practice. Lancet Infect Dis, 6, 361–72. Imray CHE, et al. (2015). Extreme expedition and wilderness medi- cine. Lancet, 386, 2520–5. Johnson C, et al. (eds) (2008). Oxford handbook of expedition and wil- derness medicine. Oxford University Press, Oxford. Johnston V (2009). Fever in returned travellers presenting in the United Kingdom: recommendations for investigation and initial management. J Infect. 59, 1–18. Khatami A, Pollard AJ (2010). The epidemiology of meningo- coccal disease and the impact of vaccines. Expert Rev Vaccines, 9, 285–98. Paredes-Paredes M, et al. (2011). Advances in the treatment of trav- elers' diarrhea. Curr Gastroenterol Rep, 13, 402–7. Ross AGP, et al. (2013). Enteropathogens and chronic illness in re- turning travelers. N Engl J Med, 368, 1817–25. Sacks R (2010). Jet lag. N Engl J Med, 362, 440–2. West JB, et al. (2012). High altitude medicine and physiology, 5th edi- tion. Arnold, London. Wilderness & Environmental Medicine (formerly Journal of Wilderness Medicine) (1990–). Published for the Wilderness Medical Society by Elsevier, London. Wills K (2013). Outdoor first aid: a practical manual: essential know- ledge for outdoor enthusiasts. Pesda Press, Bangor, UK World Health Organization (WHO) (2013). Vaccines and vaccina- tion against yellow fever. WHO position paper—June 2013. Weekly Epidemiological

Record, 88, 269–84. Wu D, Guo C-Y (2013). Epidemiology and prevention of hepatitis A in travelers. Journal of Travel Medicine, 20, 394–99. Websites General travel advice Centers for Disease Control and Prevention. Travelers' Health. http:// wwwn.cdc.gov/travel/ National Travel Health Network and Centre (NaTHNaC). Protecting the Health of British Travellers. http://www.nathnac.org National Travel Health Network and Centre. The Yellow Book. http:// www.nathnac.org/yellow_book/01.htm Public Health England. https://www.gov.uk/topic/health-protection/ infectious-diseases Royal Geographical Society. Expedition Advisory Centre. https://www. rgs.org/in-the-field/advice-training/ The International Society of Travel Medicine. http://www.istm.org Table 8.4.3 Causes of rash in returning travellers Infective Noninfective Cutaneous larva migrans; myiasis Contact allergy Cutaneous leishmaniasis Drug reaction Dengue fever Erythema multiforme Dermatophytes Insect bites Primary HIV infection Sunburn Lyme disease Meningococcal disease Mycobacteria Scabies/lice Sexually transmitted infections Tick/scrub typhus Tinea versicolor Typhoid/paratyphoid Box 8.4.2 Infective causes of eosinophilia in travellers Angiostrongylus (Parastrongylis) spp. Ascaris spp. Echinococcus spp. Filariasis (onchocerciasis) Gnathostoma spp. Hookworm and other gut nematodes Pulmonary eosinophilia Schistosomiasis Strongyloides spp. Trichinosis Trichuris spp. Visceral larva migrans

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