Travel medicine: profiling an emerging specialty

Lieutenant Colonel Peter A Leggat, BMedSc, MB BS, DipEd, DTM&H, MMedEd, DIH, MPH, PhD, FAFPHM, FACTM, FFTM, FACRRM, RAAMC

Abstract

- Travel medicine is a new multidisciplinary specialty catering for an increasing number of travellers worldwide. It is an integral part of military medicine.
- Travel medicine specialists provide pre-travel health advice, chemoprophylaxis against travel-related diseases, traveller's medical kits, and post-travel assessments and eradication treatment for various travel-related diseases. They also liaise with public health authorities on possible imported disease risks.
- Vector-borne diseases, in particular malaria and the arboviruses, stand out as major concerns for military deployments, but common problems, such as travellers' diarrhoea and respiratory tract infection, also need to be addressed.
- Travel and aviation medicine have many linkages, especially in terms of fitness to fly and dealing with problems that may arise in travellers due to physiological and psychological stresses of travel.
- Increasingly, the discipline of refugee and migrant medicine is also being included in the specialty area of travel medicine.

ADF Health 2003; 4: 72-77

INTERNATIONAL TRAVEL is increasingly common.[1] Ease of air transportation has ensured that an estimated 660 million people currently travel internationally each year to every part of the globe.[2] More than three million Australians also travel abroad each year,[3] which includes thousands of Australian Defence Force (ADF) personnel.

Travellers are potentially exposed to diseases for which they have no immunity, as well as other serious threats to well-being, such as accidents. It is conservatively estimated that 30%–50% of travellers become ill or are injured while travelling.[4] Relative estimated monthly incidence rates of various health problems have been compiled elsewhere.[5] The risk of severe injury is thought to be greater for people when travelling abroad.[1,6] Both injury and infectious diseases, such as respiratory tract infection and travellers' diarrhoea, are important concerns for travellers.[1,4,6] The main health complaints of returned Australian travellers reported in a recent survey of travel insurance claims were respiratory (20%), musculoskeletal (17%), gastrointestinal (14%), ear, nose and throat (12%), and dental conditions (7%).[7] Fortunately, few Australian travellers die abroad and those who do tend to die of pre-existing conditions, such as heart disease, but accidents are also a major contributor.[8]

This review highlights some of the current issues in travel medicine, with special reference to the ADF.

Definition of travel medicine

Travel medicine is a new multidisciplinary specialty emerging in response to the needs of the travelling population worldwide.

> Travel medicine seeks to prevent illnesses and injuries occurring to travellers going abroad and manages problems arising in travellers coming back or coming from abroad. It is also concerned about the impact of tourism on health and advocates for improved health and safety services for tourists.[9]

The latter aspect recognises the impact of travel on ecosystems around the world, particularly the introduction and spread of diseases and disease resistance.

Specialists in travel medicine consider and advise on various aspects of travel-related health, including fitness to travel and the health risks of travelling in itself, as well as considering the implications of exposure to a variety of infectious diseases and managing diseases arising from travel. This may require providing chemoprophylaxis for malaria and other diseases and various vaccinations. The areas that may be covered in the pre-travel health consultation are listed in Box 1.

Developments in travel medicine

Several key developments in the past decade have ensured the continuing emergence of travel medicine as a specialty. The Australian Government's Travel Safe program, including the development of Australian guidelines for travel medicine,[11] was an important advance, as this recognised the need for a consensus strategy for combating infectious diseases and other problems commonly encountered by travellers. These guidelines were directed to the major providers of travel health advice, which were general practitioners and public health agencies, but also travel clinics.

Australia has also seen an explosion in the establishment of dedicated specialist travel clinics operated commercially and

***Lieutenant Colonel Peter Leggat**, RAAMC, joined the Australian Regular Army in 1987. He was posted to various units, including the historic 2 Field Ambulance in Townsville. Lieutenant Colonel Leggat is currently serving as a Consultant, Defence Health Services, Army Reserve, Queensland. In 2002, he was awarded the Major General John Pearn Surgeon General's Medal for outstanding contributions to tropical medicine.*

School of Public Health and Tropical Medicine, James Cook University, Townsville, QLD.

Peter A Leggat, BMedSc, MB BS, DipEd, DTM&H, MMedEd, DIH, MPH, PhD, FAFPHM, FACTM, FFTM, FACRRM, RAAMC, Associate Professor. Correspondence: Lieutenant Colonel Peter A Leggat, School of Public Health and Tropical Medicine, James Cook University, Townsville, QLD 4811. Peter.Leggat@jcu.edu.au

within teaching hospitals and general practice. These travel clinics are usually designed to provide comprehensive pre-travel and post-travel health services, providing advice and chemoprophylaxis as well as vaccination and other commercial items, such as travellers' medical kits, mosquito nets and repellents, and water purifiers.

The first difficulties for all travel health advisers is to ensure that travellers recognise the need for travel health advice. The second is ensuring that travellers seek travel health advice in a timely manner (usually 6–8 weeks before travel) and then obtain this advice from a qualified source. One of the decisive factors in whether travellers seek health advice is the perceived risk and severity of tropical diseases.[1]

As well as preventing potentially lethal diseases and injuries among travellers abroad, travel medicine services are also increasingly recognised as important in relation to early detection and reporting of imported infections.

Professional and academic initiatives

The International Society of Travel Medicine (ISTM), established in 1991, has taken the lead in establishing a professional base for travel medicine globally. Among its initiatives are travel health alerts to subscribers, a journal, biennial conferences, a global listing of travel health practitioners, a collaborative disease reporting network (GeoSentinel) with the Centers for Disease Control and Prevention (CDC) in Atlanta,[12] and most recently a certification program based on a detailed body of knowledge in travel medicine.[13]

GeoSentinel is an excellent example of the contribution of travel medicine to early detection and reporting of imported infections.[12] ISTM also collaborates with the Asia Pacific Travel Health Association to conduct biennial conferences in travel medicine in the Asia-Pacific region, in alternate years to the ISTM's Biennial Conference. The two major journals in the travel medicine area are presently the ISTM's *Journal of Travel Medicine*, published by BC Decker, and *Travel Medicine and Infectious Diseases*, published by Elsevier Science. In Australia, the development of a professional body in travel medicine, the Australasian Faculty of Travel Medicine (FTM), was recently achieved in 2000, as part of The Australasian College of Tropical Medicine. The FTM works in close association with the New Zealand Society of Travel Medicine, established in 1997.

Comprehensive **guidelines** in travel medicine were last published by the Australian Government in 1994.[11] The key Australian government, World Health Organization (WHO), commercial and related publications that provide travel medicine guidelines and advice are listed in Box 2. There are also several valuable Internet and related resources that provide information on disease distribution and prevention (Box 3). The ADF publishes a wide range of Health Directives relating to travel medicine for the Defence Health Services. Access to policy guidelines and up-to-date health intelligence, usually provided from Internet-based resources, is essential. The research undertaken by the ADF, such as that conducted by the Australian Army Malaria Institute,[19] contributes substantially to the development of more effective countermeasures to infectious diseases associated with travel and the development of guidelines in travel medicine.

Training in travel medicine is available both nationally and internationally through certificate, diploma, or masters' degrees. In Australia, training is available at James Cook University at subject level for postgraduate programs in public health and tropical medicine and also at the level of a postgraduate certificate of travel medicine. Civil aviation medicine courses are available at several institutions in Australia, including Monash University, Griffith University, and Edith Cowan University. Military training in aviation medicine is available through the Institute of Aviation Medicine. In New Zealand, the University of Otago Medical School at Wellington offers both postgraduate certificate and diploma courses in travel and migrant medicine, as well as a related subject in airport and travel health as part of its aviation medicine courses. As previously mentioned, ISTM awards a certificate in travel medicine to successful examination candidates.[13] Other international programs in travel medicine have been listed elsewhere.[20]

1: Pre-travel preparation of Australians going aboard (modified from Leggat,[9] and Ingram and Ellis-Pegler[10])

Give advice and discuss	
Insects	repellents, nets, permethrin
Ingestions	care with food and water
Infections	skin, environment
Indiscretions	sexually transmitted infections human immunodeficiency virus
Injuries	accident avoidance, safety
Immersion	schistosomiasis
Insurance	health and travel insurance
	finding medical assistance abroad
Vaccinate	
Always	national immunisation schedule vaccines
Often	hepatitis A
Sometimes	Japanese encephalitis
	meningococcal disease
	polio
	rabies
	tetanus–diphtheria
	typhoid
	cholera
	yellow fever
Older travellers	Pneumococcus
	influenza
Prescribe	
Always	regular medication
Sometimes	antimalarial medication
	diarrhoeal self-treatment
	condoms

Vector-borne diseases

Vector-borne diseases remain among the great problems for operational deployment of the ADF. Some vector-borne diseases also represent a potential public health problem when returning home. Malaria remains the single most important vector-borne disease problem of travellers, including the military, but arboviral diseases,

such as dengue and Japanese encephalitis, are also of increasing importance. Some vector-borne diseases are important for local travel within Australia as well as overseas (eg, scrub typhus, which affected military personnel in north Queensland).[21]

Malaria

Malaria is a serious disease caused by a protozoan parasite largely confined to the tropics. WHO estimates that malaria "causes more than 300 million acute illnesses and at least one million deaths annually".[22] Most cases and deaths occur due to infection with *Plasmodium falciparum* species of malaria, however infection due to *P. vivax* also remains important, especially as dormant liver stages can cause relapses for months after returning home. Standard malaria countermeasures will be considered as part of planning for operational deployment based on Defence Health Service Health Directives and disease patterns in the area of operations. Civilian guidelines for malaria chemoprohylaxis and treatment are described elsewhere.[14]

Current countermeasures against malaria include the use of malarial chemoprophylaxis, personal protective measures, environmental health measures against disease vectors, and malaria eradication treatment for liver stages, including hypnozoites, and gametocytes on return to Australia. Growing chloroquine and multidrug resistant *P. falciparum* and, more recently, *P. vivax*, have limited the antimalarial drug options for malaria chemoprophylaxis. Current recommended malaria chemoprophylaxis regimens are doxycycline (one 100 mg tablet daily), or mefloquine (one 250 mg tablet weekly), or Malarone (one tablet daily, which consists of 250 mg of atovaquone and 100 mg of proguanil).[14] Chloroquine continues to be recommended as malaria chemoprophylaxis for malaria in the few areas where there is no chloroquine resistance. Current eradication treatment for malaria is primaquine (two 7.5 mg tablets twice daily for 2 weeks), although tafenoquine has recently been trialed in ADF personnel in East Timor as both an alternative eradication treatment (400 mg daily for three days) and as a weekly dose chemoprophylactic agent.[23]

Due to the incidence of neuropsychiatric side-effects, such as anxiety and nightmares, it is advisable for soldiers taking mefloquine for the first time to take several trial doses, commencing as early as three weeks before departure.[24] It is also advisable that soldiers who are taking other antimalarials, such as doxycycline and Malarone, are given trial doses well before departure. This is to ensure that there is time to consider alternatives if an adverse reaction is produced.[24] If the deployment is at short notice, modification to antimalarial regimens may have to be done in the field.

There are varying opinions on how long antimalarials should be continued after leaving a malarial area, but for drugs which have no pre-erythrocytic effects on the liver stages of the malarial parasite, such as doxycycline and mefloquine, prophylaxis should continue for up to four weeks after leaving the malaria-endemic area. This relates to the time it takes for parasites to develop in the liver and infect the blood stream. Malarone has some effect on the hepatic stages of *P. falciparum* parasites and may be given for shorter periods after return, (eg, one week).[25]

2: Key Australian and international guidelines and related resources used in travel medicine practice

Therapeutic Guidelines-Antibiotic[14]	Chemoprophylaxis guidelines for malaria, travellers' diarrhoea and other diseases
Australian Immunisation Handbook[15]	National Schedule and Traveller's vaccinations
Travel Bugs[16]	Immunisation and malaria chemoprophylaxis summary by country; general reference
MIMS Annual[17]	Pharmaceutical items for travellers
International Travel and Health[18]	Yellow fever areas; general reference

For travellers to more remote areas, standby treatment may also be useful. "Standby treatment consists of a course of antimalarial drugs that travellers to malaria endemic areas can use for self-treatment if they are unable to gain access to medical advice within 24 hours of becoming unwell".[24] In these situations, a traveller's medical kit may be supplied with a thermometer, possibly an immunochromatographic test (ICT) malaria diagnostic kit with written instructions, and an appropriate malaria treatment course with written instructions. Travellers who use standby treatment must seek medical advice as soon as possible. Newer antimalarials, which may be useful for standby treatment, include Malarone and Riamet (20 mg artemether and 120 mg lumefantrine).[26]

Arboviral diseases

There are many arboviral diseases that may affect travellers and military deployments. Two of the most important arboviral diseases for the ADF are dengue and Japanese encephalitis, as a number of deployments in recent years have been to areas where these diseases are endemic. Both of these diseases are transmitted by various species of mosquitoes, some of which are known to exist in Australia, especially in north Queensland, where major military bases are located.

Dengue is a major global public health problem. WHO estimates that there may be 50 million cases per year.[27] Dengue is a viral illness transmitted by *Aedes spp*. of mosquito. Infection may be subclinical, or produce an illness with fever, arthralgia and rash, or be complicated by haemorrhagic diatheses or shock syndromes. Treatment is supportive, while management of the problem is directed towards preventing transmission upon return to Australia. Numerous outbreaks of dengue in north Queensland have been attributed to travellers returning with the disease. A recent study of soldiers returning from East Timor during the incubation period of the disease showed that a collaborative effort by military and civilian public health authorities to contain and prevent the transmission of the disease among the local population was vital.[28] Until a vaccination becomes available, the mainstays of dengue prevention are personal protective measures and environmental health measures against disease vectors. (For more on dengue, see the review by Aaskov in this issue of the journal.)[29]

Japanese encephalitis is the leading cause of viral encephalitis

in Asia. WHO estimates that there are more than 70 000 cases annually in south east Asia.[30] Up to a third of patients with clinical infection die and about half have permanent residual neurological sequelae.[30] Vaccines against Japanese encephalitis are available, but their immunogenicity has recently been questioned and concerns have been raised regarding adverse reactions.[31] The development of safer and more immunogenic Japanese encephalitis vaccines[30] will be important for future ADF deployments in the region.

Preventing other infectious diseases

Many infectious diseases of travellers can be prevented by immunisation. In some circumstances, certified vaccination is required before travel. Yellow fever vaccination is required for all travellers entering or returning from a yellow fever endemic area, which is prescribed by WHO.[18] Meningococcal vaccination is required for travellers to Mecca.[18]

Various other vaccinations may be required for travellers to particular destinations. It is prudent to vaccinate against diseases that might be acquired through food and water, such as hepatitis A, typhoid and polio,[24] as well as using other measures to combat these diseases. The most common vaccine-preventable disease among travellers to date is hepatitis A.[32] Typhoid vaccination should also be considered for travel to many developing countries. Polio vaccination is rarely required these days, after a concerted campaign for global eradication, but it may be required in situations where polio outbreaks have been reported.[24] Other vaccine-preventable infectious diseases that may afflict travellers to certain destinations are listed in Box 1.

For travellers aged 65 years or more, pneumococcal and influenza vaccinations should also be considered.[15]

The development of combination vaccines, such as hepatitis A plus typhoid and hepatitis A plus B, may greatly reduce the number of injections required.[24] The development of rapid schedules for travellers departing at short notice has been useful in providing protection within four weeks.[24]

The travel medicine consultation is also an opportunity to update routine and national schedule vaccinations against diseases that may afflict travellers anywhere.

3: Examples of major Internet and related resources available for travel medicine practice*

Department of Foreign Affairs and Trade
http://www.dfat.gov.au

Communicable Diseases Intelligence
http://www.health.gov.au/pubhlth/cdi/cdihtml.htm

Immunise Australia
http://www.health.gov.au/pubhlth/immunise/index.htm

The Travel Doctor
http://www.tmvc.com.au

The Travel Clinic (Travel Clinics Australia)
http://www.travelclinic.com.au

Medical Advisory Service for Travellers Abroad
http://www.masta.edu.au

Defence Health Service
http://www.defence.gov.au/dpe/dhs

WHO, International Travel and Health
http://www.who.int/ith/index.html

WHO, Weekly Epidemiological Record
http://www.who.int/wer

CDC, Health Information for International Travel
http://www.cdc.gov/travel/index.htm

CDC, Morbidity and Mortality Weekly Report
http://www.cdc.gov/mmwr

International Society of Travel Medicine
http://www.istm.org

Faculty of Travel Medicine/New Zealand Society of Travel Medicine
http://www.tropmed.org/travel/index.html

*Internet sites last accessed 3 February 2003

Non-infectious hazards of travel

Despite the emphasis on infectious disease in travel medicine, the most common preventable causes of death among travellers are accidents and injuries.[8,32] In 1995 it was reported that about 35% of Australian deaths abroad were the result of ischaemic heart disease, with all natural causes accounting for some 50% of deaths.[8] Trauma (including homicide, suicide and execution) accounted for 26% of deaths of Australians abroad. Injuries were the reported cause of 18% of deaths, with the major injury group being motor vehicle accidents, accounting for 7% of deaths.[8] A similar pattern of mortality has been observed in Swiss,[32] American,[33] and Canadian[34] travellers abroad. Deaths of Australian tourists overseas have also resulted from air crashes, drowning, boating accidents, skiing accidents, bombs and electrocution.[8] Homicides, suicides and executions combined accounted for about 8% of all deaths.[8] Most fatal accidents in American and Swiss travellers were traffic or swimming accidents.[32,33] Infectious disease was reported as the cause of death in only 2.4% of Australians who died while travelling abroad.[8]

Issues in aviation medicine

Some travel medicine specialists are also certified by the Civil Aviation Safety Authority as Designated Aviation Medical Examiners of pilots, air traffic controllers and, in some instances, flight attendants, but all practitioners of travel medicine need to be aware of the potential health effects of modern airline travel. These include the effects of reduced atmospheric pressure, low humidity, closed environment, inactivity, disrupted circadian rhythm, alcohol, and aircraft motion.[35] These effects can produce barotrauma, dehydration, jet lag, motion sickness, claustrophobia, panic attacks and air rage, and contribute to the development of deep venous thrombosis (DVT) and venous thromboembolism (VTE).[35] Aircraft are also environments conducive to the spread of infectious disease. There have been concerns raised about the transmission of tuberculosis through close proximity to infected travellers on commercial aircraft.[36] Providing travel health advice and countermeasures for these conditions also largely falls to the specialist in travel medicine.

Some travellers need special clearance to fly in cases of aeromedical evacuation on commercial aircraft and in certain

prescribed circumstances, such as serious physical or mental incapacity or after recent surgery.[35] Liaison with the airline's medical department is usually advisable.

Travel medicine is also a key component of the activities of many health professionals working in aviation medicine. In addition to undertaking aviation medical examinations and advising their own staff, airline medical departments review passengers' clearances to fly and provide advice to travel health advisers. They are also involved in developing policies and guidelines for managing in-flight emergencies involving travellers and for training flight attendants in first aid. Physicians working in aviation medicine have their own professional organisation, the Aviation Medical Society of Australia and New Zealand, which holds regular conferences and produces a journal, *Avmedia*.

Recently, considerable attention has been focused on DVT and VTE, but it remains uncertain what the contribution of air travel is to the development of this condition among travellers. What seems to be clear is that the development of DVT and VTE is multifactorial.[37] While the identification of travellers with predisposing risk factors would seem useful, it is only an option where the risks of side-effects of the screening procedure do not outweigh the risks of developing DVT after a long haul flight, which is estimated to be about 1 in 200 000 for travellers on a 12-hour flight.[38] In the meantime, conservative measures should be recommended, such as in-flight exercises, restricting alcoholic and caffeinated beverages and drinking lots of water. For some travellers with an increased risk of DVT, other preventive measures, such as subcutaneous heparin, are worthy of investigation.[38] Current epidemiological research and pathophysiological studies are helping to establish which travellers are at greatest risk, which will in turn lead to appropriate intervention studies.

Issues in refugee and migrant medicine

In 1997, the United Nations High Commission for Refugees (UNHCR) estimated that there were more than 20 million refugees and internally displaced persons who came under the UNHCR mandate.[39] Illegal migration and trafficking in migrants, usually from poor countries to rich countries, is a worldwide phenomenon. Many successfully gain asylum in their host countries. Rarely are migrants properly prepared for travel to their new homes, and greater co-operation and health planning is needed between their home and host countries.

Migration has important health implications. Migrants often have a higher rate of various infectious diseases than other travellers, as well as psychological disorders as a result of previous ordeals and the stress of leaving their homeland.[40] Refugees and illegal migrants should be screened for various infectious and parasitic diseases such as tuberculosis, hepatitis B and C, schistosomiasis, malaria, and sexually transmitted infections (including syphilis and HIV).[40] Chronic diseases also need to be considered, such as diabetes, cardiovascular disease, malignancies, asthma and other chronic respiratory conditions.[40] Health services, including those provided by the ADF, need to understand and respond to the wide and varied travel health problems of refugees and migrants, especially illegal immigrants.

4: Further reading

- Leggat PA, Goldsmid JM, editors. Primer of travel medicine. 3rd ed. Brisbane: ACTM Publications, 2002.
- Mardh PA. What is travel medicine? Content, current position, tools and tasks. *J Travel Med* 2002; 9: 34-47.
- Zuckerman JN, editor. Principles and practice of travel medicine. Chichester: John Wiley and Sons, 2001.

Travellers' resources

- Mills D. Travelling well: the essential handbook for healthy travel. Brisbane: The Travel Doctor, 2000 (see http://www.travellingwell.com.au)
- Cohen J. The traveller's pocket medical guide and international certificate of vaccination. Melbourne: The Travel Clinic, 2002. (see http://www.travelclinic.com.au)

Internet sites last accessed Jul 2003.

Competing interests

None declared.

References

1. Behrens RH. Protecting the health of the international traveller. *Trans R Soc Trop Med Hyg* 1990; 84: 611-612, 629.
2. World Tourist Organisation. Tourism highlights. Madrid: World Tourist Organisation, 1998.
3. Australian Bureau of Statistics. 3401.0 Overseas arrivals and departures, Australia, September 2002, Canberra, 2002. Available at: http://www.abs.gov.au/ausstats/abs@.nsf/mf/3401.0 (accessed Feb 2003).
4. Cossar JH, Reid D, Fallon RJ, et al. A cumulative review of studies on travellers, their experience of illness and the implications of these findings. *J Infect* 1990; 21: 27-42.
5. Steffen R, DuPont HL. Travel medicine: what's that? *J Travel Med* 1994; 1: 1-3.
6. Bewes PC. Trauma and accidents: practical aspects of the prevention and management of trauma associated with travel. *Br Med Bull* 1993; 49: 454-464.
7. Leggat PA, Leggat FW. Travel insurance claims made by travellers from Australia. *J Travel Med* 2002; 9: 59-65.
8. Prociv P. Deaths of Australian travellers overseas. *Med J Aust* 1995; 163: 27-30.
9. Leggat PA, Ross MH, Goldsmid JM. Ch. 1. Introduction to travel medicine. In: Leggat PA, Goldsmid JM, editors. Primer of travel medicine. 3rd ed. Brisbane: ACTM Publications, 2002: 3-21.
10. Ingram RJH, Ellis-Pegler RB. What's new in travel medicine? *N Z Public Health Rep* 1996; 3(8): 57-59.
11. Commonwealth Department of Health. Health information for international travel, 1995. 4th ed. Canberra: Australian Government Publishing Service, 1994.
12. Freedman DO, Kozarsky PE, Weld LH, Cetron MS. GeoSentinel: the global emerging infections sentinel network of the International Society of Travel Medicine. *J Travel Med* 1999; 6: 94-98.
13. Kozarsky PE, Keystone JS. Body of knowledge for the practice of travel medicine. *J Travel Med* 2002; 9: 112-115.
14. Spicer J, Christiansen K, Currie B, et al. Therapeutic guidelines: antibiotic. Version 11. North Melbourne: Therapeutic Guidelines Limited, 2000.
15. National Health and Medical Research Council. Australian immunisation handbook. 5th ed. Canberra: Australian Government Publishing Service, 2000.
16. CSL Vaccines. Travel bugs: country by country guide to immunisation for international health. Parkville: CSL Vaccines, 1999.
17. Caswell A, editor. 2002 MIMS annual. St Leonards: MIMS Australia, 2002.
18. World Health Organization. International travel and health. Geneva: WHO, 2002. Available at: http://www.who.int/ith (accessed Feb 2003).
19. Health Service Profile: Australian Army Malaria Institute. *ADF Health* 2000; 1(3): back cover.
20. International Society of Travel Medicine. Conferences under Travel Medicine Exam. Available at: http://www.istm.org (accessed Feb 2003).
21. McBride WJH, Taylor CT, Pryor JA, Simpson JD. Scrub typhus in north Queensland. *Med J Aust* 1999; 170: 318-320.
22. World Health Organization. Malaria. Fact Sheet 94. Revised October 1998. Available at: http://www.who.int/inf-fs/en/fact094.html (accessed Jul 2003).

23. Edstein MD, Nasveld PE, Rieckmann KH. The challenge of effective chemoprophylaxis against malaria. *ADF Health* 2001: 2: 12-16.
24. Zuckerman JN. Recent developments: travel medicine. *BMJ* 2002; 325: 260-264.
25. Looareesuwan S, Chulay JD, Canfield CJ, Hutchinson DB. Malarone (atovaquone and proguanil hydrochloride): a review of its clinical development for treatment of malaria. Malarone Clinical Trials Study Group. *Am J Trop Med Hyg* 1999; 60: 533-541.
26. Omari AA, Preston C, Garner P. Artemether–lumefantrine for treating uncomplicated falciparum malaria. *Cochrane Database Syst Rev* 2002; (3): CD003125.
27. World Health Organization. Dengue and dengue haemorrhagic fever. Fact Sheet No. 117. Available at: http://www.who.int/inf-fs/en/fact117.html (accessed Jul 2003).
28. Kitchener S, Leggat PA, Brennan L, McCall B. The importation of dengue by soldiers returning from East Timor to north Queensland, Australia. *J Travel Med* 2002; 9: 180-183.
29. Aaskov JG. Dengue. *ADF Health* 2003; 4: 66-71.
30. Kitchener S. Most recent developments in Japanese encephalitis vaccines. *Aust Mil Med* 2002; 11: 88-92.
31. Kurane I, Takasaki T. Immunogenicity and protective efficacy of the current inactivated Japanese encephalitis vaccine against different Japanese encephalitis virus stains. *Vaccine.* 2000; 18 (Suppl. 2): 33-35.
32. Steffen R. Travel medicine: prevention based on epidemiological data. *Trans R Soc Trop Med Hyg* 1991; 85: 156-162.
33. Baker TD, Hargarten SW, Guptill KS. The uncounted dead — American civilians dying overseas. *Public Health Rep* 1992; 107: 155-159.
34. MacPherson DW, Gurillot F, Streiner DL, et al. Death and dying abroad: the Canadian experience. *J Travel Med* 2000; 7: 227-233.
35. Graham H, Putland J, Leggat P. Ch. 8: Air travel for people with special needs. In. Leggat PA, Goldsmid JM, editors. Primer of travel medicine. 3rd ed. Brisbane: ACTM Publications, 2002: 100-112.
36. World Health Organization. Tuberculosis and air travel. Geneva: WHO, 2001.
37. Mendis S, Yach D, Alwan A. Air travel and venous thromboembolism. *Bull World Health Organ* 2002; 80: 403-406.
38. Gallus AS, Goghlan DC. Travel and venous thrombosis. *Curr Opin Pulm Med* 2002; 8: 372-378.
39. United Nations High Commissioners for Refugees. Statistical reports. Available at: http://www.unhcr.ch/statistics (accessed Feb 2003).
40. Loutan L. Ch. 28: The health of migrants and refugees. In: Zuckerman JN, editor. Principles and practice of travel medicine. Chichester: John Wiley and Sons, 2001: 467ZP-475.

(Received 12 Jan 2003, accepted 26 Mar 2003) ❑