Travel Medicine and Tourist Health

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Abstract Following a period of steady growth in tourism, COVID-19 has caused a tremendous decrease in tourist numbers travelling around the world. With the advent of COVID-19 vaccine programs we will no doubt see a resurgence in travel, but it may take years to recover to pre-COVID-19 levels. Travel medicine aims to assist travellers remain healthy and safe during their travels and will be very important to the recovery of tourism globally. Indeed, travel medicine will likely play a key role in when we can travel normally again.

Keywords Travel · Medicine · Tourist · Health · COVID-19

Introduction

There has been an increasing trend for people to travel internationally. Ease of air transportation has ensured that a record 1.46 billion people travelled internationally to every part of the globe in 2019 (United Nations World Tourism Organization [UNWTO], 2020). However, in 2020, there was a 73% decrease in tourism due to the ongoing impacts of the COVID-19 pandemic and a decrease of 87% in tourism in January 2021 (UNWTO, 2021). Many in the press have described this as a tourism cliff, and recovery will largely depend on COVID-19 vaccine rollout, *travel bubbles* and sound pre-travel health advice.

Travellers are potentially exposed to infectious diseases for which they have no immunity, as well as other serious threats to wellbeing, such as accidents and exacerbation of pre-existing medical and dental conditions. Conservatively, it is estimated that between 30–50% of travellers and tourists become ill or injured whilst travelling (Cossar et al., 1990; Leggat & Zuckerman, 2015). Relative estimated

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monthly incidence rates of various health problems have been compiled elsewhere (Steffen, 2018). The risk of severe injury is thought to be greater for people when travelling abroad (Cossar et al., 1990; Leggat & Zuckerman, 2015; Steffen & DuPont, 1994).

This chapter reviews current health and safety issues in travel medicine and tourist health, describes the discipline of travel medicine and how this may usefully impact on tourist health, highlights developments in the field, and discusses the various agencies working in this area.

Morbidity and Mortality of Travellers

In terms of morbidity, infectious diseases such as respiratory tract infection and travellers' diarrhoea, and injuries are important concerns for travellers (Bewes, 1993; Cossar et al., 1990; Nothdurft & Caumes, 2013). The main health complaints of returned Australian travellers reported in a 1999 survey of travel insurance claims included respiratory (20%), musculoskeletal (17%), gastrointestinal (14%), ear, nose and throat (12%), and dental conditions (7%) (Leggat & Leggat, 2002). This compares with the major specified illnesses and accidents reported in a Swiss study, which included infectious disease (43.5%), accidents involving the extremities (15.3%), psychiatric conditions (8.2%), pulmonary disorders (4.7%), and accidents involving the head (4.7%) (Somer Kniestedt & Steffen, 2003).

Fortunately, only a relatively small proportion of travellers die abroad and those that do tend to die, die of pre-existing conditions, such as myocardial infarction in travellers with known ischaemic heart disease. However, accidents are also a major cause of travel-related mortality (Leggat & Wilks, 2013; Prociv, 1995; see also *Part II Safety: Tourist Injury*). A study published by Baker et al. (1992) analysed deaths of Americans while overseas (nearly 5000 per year) and concluded that most Americans who die overseas do so in developed countries of Western Europe and the causes of death are similar to the U.S. Moreover, deaths of Americans in less developed countries are not from infections and tropical diseases, but are mainly from chronic diseases, injuries, drowning, suicides, and homicides. Similarly, studies of deaths of Australian, Canadian, American and Swiss travellers found that cardiovascular disease, accidents and injuries, were among the most common causes of death abroad (Baker et al., 1992; MacPherson et al., 2000; Prociv, 1995; Leggat & Wilks, 2009; Steffen, 1991).

Defining Travel Medicine

Travel medicine is a multidisciplinary specialty area, which has emerged in response to the needs of the travelling population worldwide.

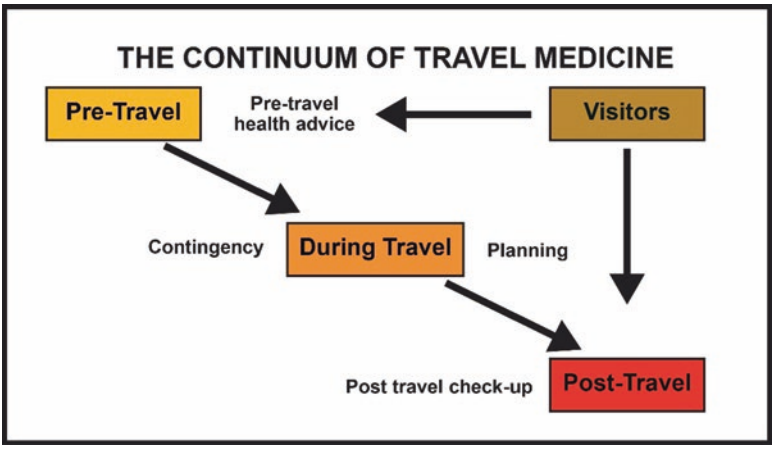

Fig. 1 The Continuum of Travel Medicine. (Source: Developed by Professor Peter Leggat)

> 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. Tourist health is also concerned about the impact of tourism on health and advocates for improved health and safety services for tourists (Leggat et al., 2005b, p. 3).

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 exposure to infectious diseases and diseases arising from travel. In this respect, travel medicine can be regarded as a continuum (see Fig. 1), which provides for pre-travel, during travel and post-travel health advice for travellers. This may necessitate the provision of malaria and other chemoprophylaxis or treatment, and various vaccinations. In this respect, Steffen and DuPont (1994, p. 1) state that "…the art of travel medicine is selecting the necessary prevention strategy without unnecessary adverse events, cost or inconvenience" and that "Travel medicine prevention should be based on epidemiological data" (Steffen, 1991, p. 156).

The areas that may be covered in the pre-travel health consultation with travellers are listed in Table 1.

International Developments in Travel Medicine and Tourist Health

Several key developments in the past decade have ensured the continuing emergence of travel medicine as a specialty area. The World Health Organization (WHO, 2016) *International Health Regulations* and compulsory immunisation contributed significantly to the development of travel medicine. Current travel health practice

Table 1 Areas that might be covered in pre-travel health consultations

Advise/Discuss	
Insects	Repellents, nets, permethrin
Ingestions	Care with food and water
Infections	Skin; environment
Indiscretions	STDs, HIV.
Injuries	Accident avoidance, safety
Immersion	Schistosomiasis
Insurance	Health and travel insurance
	Finding medical assistance abroad
	First aid advice
Vaccinate	
Always	National immunisation schedule vaccines
Often	Hepatitis A
Sometimes	Japanese encephalitis
	Meningococcal disease
	Polio
	Rabies
	Tetanus-diphtheria
	Typhoid
	Yellow fever
Older travellers	Pneumococcus
	Influenza
Prescribe	
Always	Regular medication
Sometimes	Antimalarial medication
	Diarrhoeal self-treatment
	Condoms
	Traveller's medical kit

Source: Modified from Leggat, Ross and Goldsmid (Leggat et al., 2005b) and Ingram and Ellis-Pegler (1996), STDs (Sexually-transmitted diseases), HIV (Human immunodeficiency virus)

often relies on travellers' need for compulsory yellow fever immunisation, based on the epidemiology of the disease. The development of WHO (2012) guidelines on travellers' health, *International Travel and Health*, was also an important advance as this recognised the need to develop a consensus strategy for combating commonly encountered infectious diseases and other problems encountered by travellers.

Professional Initiatives

The International Society of Travel Medicine (ISTM), established in 1991, has taken the lead in establishing a global professional base for travel medicine (ISTM, 2021). Some of the early initiatives of the ISTM were the provision of travel health alerts to subscribers, a journal, biennial conferences, a global listing of travel health

Table 2 Examples of major Internet and related resources in travel medicine practice

Name of Resource	Internet address[a]
WHO, International Travel and Health	http://www.who.int/ith
WHO, Weekly Epidemiological Record	http://www.who.int/wer
CDC, Health Information for International Travel	https://wwwnc.cdc.gov/travel
CDC, Morbidity and Mortality Weekly Report	http://www.cdc.gov/mmwr
International Society of Travel Medicine	http://www.istm.org

[a]Internet sites accessed 12 April 2021

practitioners, and a collaborative disease-reporting network (GeoSentinel) with the United States Centers for Disease Control and Prevention (CDC) (Freedman et al., 1999). GeoSentinel has played a role regionally in examining health problems post-travel (Freedman et al., 1999; Hamer et al., 2020). The ISTM has also developed an examination program based on a detailed Body of Knowledge in travel medicine leading to a Certificate of Travel Health (Kozarsky & Keystone, 2002). GeoSentinel is an excellent example of the contribution of travel medicine to the early detection and reporting of imported infections to which sites globally contribute (Freedman et al., 1999; Hamer et al., 2020).

Regional societies and faculties of travel medicine have also flourished, such as the Asia Pacific Travel Health Society, which conducts biennial conferences in travel medicine and tourist health in the Asia-Pacific region, in alternate years to the ISTM's Biennial Conference. The three major journals in the field of travel medicine are presently the ISTM's *Journal of Travel Medicine* published by Oxford University Press, *Travel Medicine and Infectious Diseases* published by Elsevier Science, and *Tropical Diseases, Travel Medicine and Vaccines* published by Springer Nature.

Comprehensive international guidelines in travel medicine and tourist health are published by the WHO (2012), as well as by many member countries, which provide guidelines and advice for travel medicine practice. In addition, there are a number of useful Internet and related resources, which provide valuable information on disease distribution and prevention (see Table 2), which have also been discussed elsewhere (Leggat, 2003). Access to current policy guidelines and up-to-date health intelligence, usually provided in travel medicine from Internet-based resources, is essential. Continuing research is also crucial for a better understanding of the epidemiology of travel-related diseases and injuries, which in turn leads to the development of improved guidelines in travel medicine and more effective countermeasures to combat infectious diseases and prevent injuries associated with travel.

Postgraduate Education

Travel medicine and tourist health education is available both nationally and internationally through a range of postgraduate study options, including graduate certificate, graduate diploma, or masters' degree level programs. Several courses in travel, tropical, and migrant medicine are available throughout the world and many are

listed at the ISTM website from time-to-time. As previously mentioned, the professional certificate of knowledge initiative from the ISTM includes recognition for successful examination candidates with a Certificate in Travel Health (ISTM, 2021).

Travel Medicine Practice

Three main challenges initially confront the establishment of effective travel medicine practice. The first challenge is that travellers must recognise the need for travel health advice before travelling abroad. One airport survey suggested that only 50% of Australian travellers abroad had sought pre-travel health advice (Wilder-Smith et al., 2004). The second challenge is ensuring that travellers seek travel health advice in a timely manner, preferably at least six to eight weeks before travel. The third challenge is for travellers to obtain travel health advice from a qualified source (Leggat, 2000). The airport survey previously mentioned found that only one-third of travellers had sought pre-travel health advice from a health professional (Wilder-Smith et al., 2004).

Many of these challenges can be at least partially addressed through industry and government co-operation, particularly at the level of the travel agent or airline, which will have initial contact with travellers. Although general practitioners (GPs) remain at the forefront of the provision of travel health advice, pre-COVID-19, there has been an explosion in the establishment of dedicated specialist travel clinics, many operated commercially with others being developed within teaching hospitals and general practices (Hill & Behrens, 1996). From earlier studies, it has been found that only 44% of travellers were seeking pre-travel health advice, mostly from travel agents (Cossar et al., 1990), although other studies have shown preferences for seeing GPs as high as 65% (Cossar et al., 1990). Airport surveys in Bangkok and Sydney suggested that only 35% were seeking pre-travel health advice from a health professional, the majority from GPs (Heywood et al., 2012).

Although we are yet to emerge from COVID-19, travel medicine continues to work with other areas of medicine and government agencies to determine when it is safe to start planning travel and to assist in determining what may be required for travel during the COVID-19 era, as complete elimination of the virus may not be possible in the short term. COVID-19 vaccinations are already being rolled out in many countries around the world; however, these vaccines are not necessarily 100% protective and may need two (2) vaccinations or even boosters down the track (Shlim et al., 2021). There may also be those who refuse vaccination and, if permitted to travel, will require advice about COVID-19 prevention (Shlim et al., 2021). There will also need to be close co-operation with airlines to ensure travel is as COVID-19 safe as possible with all useful measures employed (Alshahrani et al., 2021; see also *Part V Government and Industry Activity: Creating a Safer Journey: Exploring Emerging Innovations in the Aviation Sector*).

Public health continues to have a major role in quarantining returning travellers through public health legislation based on the incubation period of COVID-19,

which ranges from 1 to14 days, but is most commonly 5 to 6 days (WHO, 2021a). COVID-19 is also easily caught from others who have the virus. The disease can spread from person to person through small droplets from the nose or mouth, which are spread when a person with COVID-19 coughs or exhales (WHO, 2021a). These droplets land on objects and surfaces around the person. Other people then catch COVID-19 by touching these objects or surfaces, and then touching their eyes, nose or mouth. People can also catch COVID-19 if they breathe in droplets from a person with COVID-19 who coughs out or exhales droplets (WHO, 2021a). Hence, COVID-19 can also be transmitted in hotel and other quarantine facilities, if these droplets are allowed to spread. Contact tracing is the process of identifying, assessing, and managing people who have been exposed to a disease to prevent onward transmission (WHO, 2021a). These people are called contacts. Contact tracing for COVID-19 requires identifying people, who may have been exposed to SARS-CoV-2, the virus that causes COVID-19, and following them daily for 14 days (WHO, 2021a, p. 2).

Travel Clinics

Travel clinics are usually designed to provide comprehensive pre-travel and post-travel health services (Virk & Jong, 2013), including the provision of advice and chemoprophylaxis as well as vaccination and other commercial items, such as travellers' medical kits, mosquito nets and repellents, and water purifiers. In travel clinics, typically health advice would be provided by a physician in 40.7% of cases, the nurse and the physician in 41.9%, and the nurse only in 15.6% (Hill & Behrens, 1996). It has been suggested that about 5000 patients per year were needed to economically sustain a dedicated travel medicine clinic (Freedman, 1996); however, only 13% of the world's travel clinics see more than 5000 patients per year (Hill & Behrens, 1996). The average number seen by these clinics was 750 (range 6–50,000) patients per year (Hill & Behrens, 1996), with a median opening time of 35 hours per week. Often these clinics would need to undertake other work, such as occupational health, aviation medicine, public health or general practice, in order to operate full-time. Considerable variability in the accuracy and extent of advice provided by North American travel health advisers has been found previously (Keystone et al., 1994).

General Practice

A survey of GPs in Glasgow indicated that 87% believed that primary care was the best level at which to provide travel health advice and only about 8% of GPs recommended a travel medicine clinic (Cossar & Reid, 1992). Several studies have shown that general practitioners usually provide advice on travel vaccinations, malaria chemoprophylaxis, insect bite avoidance, geographic diseases, and traveller's

diarrhoea during travel health consultations (Leggat et al., 1999; Seelan & Leggat, 2003). However, the adequacy of advice given by GPs has also been the subject of some studies, and one study went as far as to suggest that general practice was not the best place to provide travel health advice (Jeffries, 1989). Considerable variability in the advice provided by GPs has been found in studies done elsewhere (Holden, 1989). A study by Carroll et al. (1998) of GPs and practice nurses in the UK indicated that more nurses (98%) gave pre-travel health advice and immunisations to travellers than GPs (87% and 48% respectively) and nurses saw more travellers than GPs per month (28 compared with 10).

Travel Industry

Although there are still relatively few studies looking at the travel health advice provided by the travel industry, there have been deficiencies noted in brochures provided by travel agents. In one report (Reid et al., 1986) health information was absent from one-third of brochures; only 11% gave specific health information, and around half of the brochures gave very general health advice. There have also been deficiencies noted in the knowledge of and advice given by travel agents to travellers concerning their health while travelling (Lobel et al., 1987, 1990; Malcolm, 1996). The airline industry serving Australia, for example, has been shown to have a paucity of destination-specific information in their in-flight magazines (Leggat, 1997). Mobile phone apps and functions have also become powerful sources of information (Lai et al., 2019).

Other Sources of Health Advice

It has been proposed that public health was "generally better equipped to offer comprehensive updated advice than are private practitioners" in the area of travel medicine (MacDonald et al., 1995, p. 103). Travel health advice may also be obtained from the Internet and the media. The information provided at travel medicine internet sites, from Apps and in the media tends to be fairly general or "regional", which can be misleading unless the travellers or the travel health adviser has the knowledge and training to source and interpret the best information available.

Barriers to Accessing Pre-travel Health Advice

There are a number of potential barriers to travellers seeking adequate pre-travel health advice. The reasons may include:

- Financial
- Ability to access health services
- Language
- Cultural/different belief systems
- Perception that they are not at risk.

Visiting friends and relatives (VFR) travellers are also less likely to access pre-travel health advice (Leder et al., 2011).

Infectious Hazards of Travel

One of the most important factors in whether travellers seek health advice at all is the perceived risk and severity of tropical diseases (Kain et al., 2019), despite their relatively low health and safety risk to travellers in comparison to accidents and less exotic conditions like travellers' diarrhoea. In addition to the prevention of potentially lethal diseases and injuries amongst travellers abroad, the importance of providing travel health services is also increasingly being recognised in relation to early detection and reporting of imported infections, such as through GeoSentinel (Freedman et al., 1999). Important infectious hazards of travel include vector-borne diseases, including malaria and arboviral diseases, and vaccine preventable diseases (see Fig. 2), which now includes COVID-19.

Vector-Borne Diseases

Vector-borne diseases remain among the great personal concerns for travellers abroad, especially those travelling to more remote tropical areas. 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; however, arboviral and rickettsial diseases are also becoming increasingly important international travel-related health problems.

Malaria

Malaria is a serious disease caused by a protozoan parasite largely confined to the tropics. The WHO estimates that there were 229 million cases of malaria infection and 409,000 deaths due to malaria worldwide in 2019 (WHO, 2021b). 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

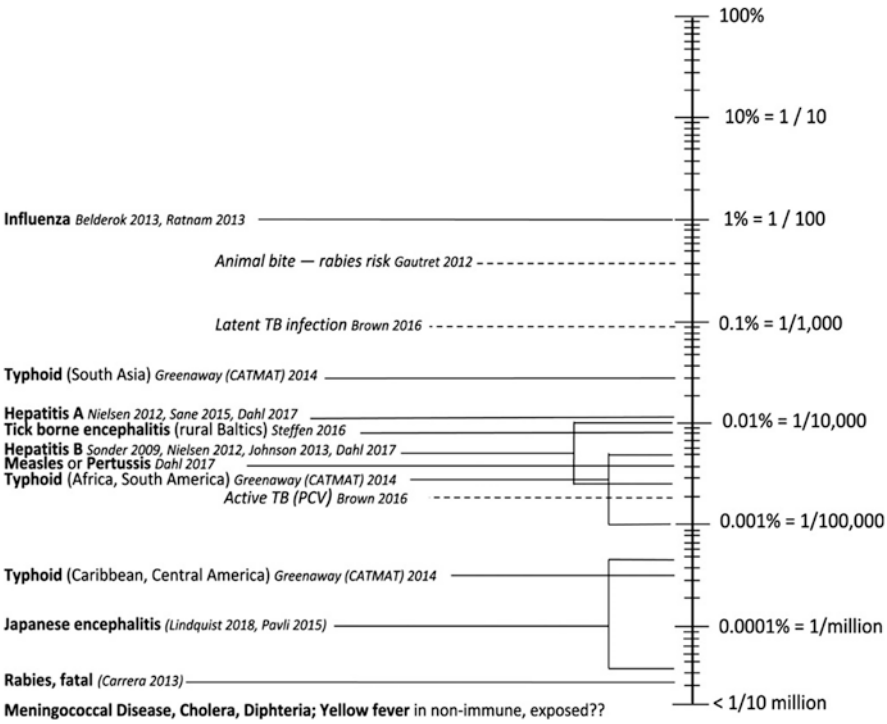

Fig. 2 Vaccine preventable disease travel health risks: Estimated incidence per month in lower income countries among non-immunes. (Source: Adapted from Steffen, (Steffen, 2018, p. 1), used with permission)

liver stages of the life cycle or hypnozoites can cause relapses, sometimes several, for months after returning home.

Standard malaria preventive measures are considered as part of pre-travel health planning for travellers based on malaria endemicity patterns and policy guidelines. Current disease prevention measures against malaria include the use of malarial chemoprophylaxis, personal protective measures against insect bites, environmental health measures against disease vectors—where feasible, malaria eradication treatment for liver stages and gametocytes on return home, and early detection and treatment of malaria cases in order to avoid serious complications of the infection.

Guidelines for malaria chemoprophylaxis and treatment are described in various travel medicine guidelines. The growing incidence of multidrug resistance in *P. falciparum* and, more recently, *P. vivax*, has limited the antimalarial drug options for malaria chemoprophylaxis. Current recommended malaria chemoprophylaxis options generally include doxycycline (one 100 mg tablet daily), mefloquine (one tablet weekly), and atovaquone plus proguanil or Malarone (one tablet daily which consists of 250 mg of atovaquone and 100 mg of proguanil) (Antibiotic Expert Group, 2019). 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 registered as both an alternative eradication treatment or radical cure for *P. vivax* (300 mg: two 150 mg tablets on day 1 or 2 of the three-day chloroquine course, Therapeutic Goods Administration [TGA], 2018).

Due to the incidence of neuropsychiatric side effects, such as anxiety and nightmares, it is advisable for travellers taking mefloquine for the first time to take several trial doses, possibly commencing as early as three weeks before departure (Looareesuwan et al., 1999). A protocol for determining eligibility for prescribing mefloquine has been described elsewhere (Antibiotic Expert Group, 2019). It is also advisable that travellers are given trial doses of other antimalarials, such as doxycycline and Malarone that they might be taking for the first time well before departure. This is to ensure that there is time to consider alternative chemoprophylactic drugs (Zuckerman, 2002). If travel is commenced at short notice, modification to antimalarial regimens may have to be done abroad, which is less satisfactory. There are varying opinions on how long antimalarial drugs should be continued after leaving an antimalarial area. However, antimalarial drugs, which have no pre-erythrocytic effects on the liver stages of the malarial parasite, such as doxycycline and mefloquine, should be continued for up to four weeks afterwards. This relates to the time it takes for parasites to develop in the liver and infect the bloodstream. Chemoprophylaxis with Malarone, which also has some effects on the hepatic stages of *P. falciparum* parasites, may be able to be given for shorter periods after return, for example one week after return (Looareesuwan et al., 1999) or perhaps even a few days (Antibiotic Expert Group, 2019).

For travellers to more remote areas, standby treatment, in the event of overt malaria infection whilst abroad, 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" (Zuckerman, 2002, p. 262). In these situations, a travellers' medical kit may be supplied with a thermometer, possibly an immunochromatographic test (ICT) malaria diagnostic kit and written instructions, an appropriate malaria treatment course and written instructions, but regardless travellers must seek medical advice, as soon as possible. Antimalarials, which may be useful for standby treatment, include Malarone and artemether containing compounds such as Riamet (20 mg artemether and 120 mg lumefantrine) (Antibiotic Expert Group, 2019).

Arboviral Diseases

There are many arboviral diseases that may impact on travellers and about two-thirds of the world's population live in areas infested with yellow fever and dengue vectors, mainly *Aedes aegypti* mosquitoes. Two of the most important arboviral diseases for travellers are Dengue fever and Japanese Encephalitis (JE), but also

Zika, as people are travelling to more remote areas in recent years, where these diseases are endemic. These diseases are in addition to Yellow Fever, which has a widespread distribution in many parts of South American and African countries and is controlled by International Health Regulations (WHO, 2016).

Dengue fever is a major global public health problem. The WHO estimates that there are between 100 to 400 million cases per year (WHO, 2020). Dengue is a viral illness transmitted by *Aedes sp*. of mosquito, classically *Aedes aegypti.* Infection may range from being subclinical to fever, arthralgia and rash, or be complicated by haemorrhagic diatheses or shock syndromes. Treatment is supportive, while management of the problem is directed towards early detection of the disease and preventing transmission upon return to receptive countries (Malcolm et al., 1999). Numerous outbreaks of Dengue have been attributed to travellers returning with the disease associated with delays in detecting the condition in recent work conducted in northern Australia (Malcolm et al., 1999). With travellers arriving or returning from abroad during the incubation period of the disease, it is vital that there is a collaborative effort made by various civilian public health authorities to contain and prevent the transmission of the disease amongst the local population (Kitchener et al., 2002). While the first dengue vaccine has been approved by a number of national regulatory authorities, it appears that trial participants who were seronegative at the time of first vaccination had a higher risk of more severe dengue and hospitalisations from dengue compared to unvaccinated participants (WHO, 2020). While the dengue vaccine may continue to have a place, the mainstays of Dengue prevention are personal protective and environmental health measures against disease vectors (WHO, 2020).

JE is the leading cause of viral encephalitis in Asia. The WHO estimates that there are around 68,000 clinical cases annually in South East Asia and the western Pacific region (WHO, 2019). The case fatality rate can be as high as 30% and about 30–50% of clinical cases with encephalitis can have permanent residual neurological sequelae (WHO, 2019). There are now relatively safe and effective vaccines against JE (Barzon & Palú, 2018). Travellers planning to spend extensive time in JE endemic areas should be vaccinated (WHO, 2019).

Zika is also a mosquito-borne flavivirus that was identified more than 70 years ago in Uganda (WHO, 2018). Sporadic outbreaks of Zika have occurred around the world. A large outbreak of Zika in Brazil in 2015 was found to be associated with Guillain-Barre syndrome and microcephaly (WHO, 2018). Eighty-six countries and territories have now reported evidence of mosquito-borne Zika infection (WHO, 2018). Travellers and those living in affected areas should take basic precautions to protect themselves from mosquito bites. Travellers who are pregnant or intending to become pregnant need to be counselled regarding congenital Zika infection (WHO, 2018).

Table 3 Vaccinations that may be given in the travel health setting

	Definition	Implications for travel	Examples
Routine	Included in the national schedule	A travel consultation is an opportunity to ensure routine vaccinations are up to date	Diphtheria, tetanus, polio, measles, mumps, rubella, hepatitis B
Recommended	Recommended following a risk assessment	Recommended according to an individuals' risk assessment taking into consideration factors, such as destination, length of stay and planned activities	Cholera, hepatitis A, Japanese encephalitis, meningococcal, rabies, tick-borne encephalitis, typhoid, tuberculosis
Required	Required under International Health Regulations (WHO, 2019) or as a visa requirement or where a country has stipulated required outside	Proof of vaccination (meningococcal or an International Certificate of vaccination or Prophylaxis (yellow fever) may be required	Meningococcal, yellow fever, COVID-19?

Source: Adapted from Wong and Simons (2013)

Prevention of Infectious Diseases Through Vaccination

A number of infectious diseases of travellers can be prevented by immunisation (see Table 3). There are few mandatory vaccines, for which certification is necessary, and these include yellow fever and meningococcal meningitis. Yellow fever vaccination is required for all travellers entering or returning from a yellow fever endemic area, which is prescribed by the WHO (2012). Meningococcal vaccination is required for travellers to Mecca (WHO, 2012).

The travel medicine consultation is also an opportunity to update routine and national schedule vaccinations, which may afflict travellers anywhere. There are also a variety of vaccinations, which may be required for travellers to particular destinations. It would seem prudent to vaccinate travellers against diseases that might be acquired through food and water, such as hepatitis A, typhoid and polio (Zuckerman, 2002), as well as using other measures to combat these diseases. The most common vaccine preventable disease is influenza (Steffen, 2018); however, typhoid vaccination should also be considered for travel to many developing countries. Polio vaccination is rarely required these days, with a concerted campaign for global eradication; however it may be required in situations where polio outbreaks have been reported (Steffen, 2018; Zuckerman, 2002).

There are a number of other infectious diseases, such as tick-borne encephalitis, hepatitis B, JE and rabies (Steffen, 2018), which may afflict travellers to certain destinations or are a result of the nature of their travel, that are vaccine preventable (see Table 1). For older travellers, pneumococcal and influenza vaccinations should also be considered. The development of combination vaccines, such as hepatitis A plus typhoid and hepatitis A plus B, has reduced the number of injections required

(Zuckerman, 2002). The development of rapid schedules for travellers departing at short notice has been useful in providing protection within four weeks (Zuckerman, 2002).

Of course, going forward, COVID-19 vaccination is likely to be a priority before tourists begin to travel again. Counselling for COVID-19 vaccination and prevention will be necessary by travel health advisors as the present suite of COVID-19 vaccinations are not 100% protective and have not been studied over the long term (Shlim et al., 2021). Interim guidance has been provided around evaluation of COVID-19 vaccines by the World Health Organization (WHO, 2021c). There are currently four main types of COVID-19 vaccination, including those based on the whole virus, protein sub-unit, nucleic acid (such as Pfizer's vaccine), and based on a viral vector (such as the Oxford AstraZeneca vaccine, Gavi [The Vaccine Alliance], 2021). There has been considerable discussion around how COVID-19 vaccination will be documented. One approach is a vaccine passport, which may be digital in nature (Needham, 2021). It will be important that all countries work out what will be required in the future to allow for travel during the COVID-19 era.

In addition, the usual travel-related disease risks will still be around, and travellers will need to see a travel medicine practitioner when planning to travel to resource-poor countries. Many diseases have no vaccination. For example, some parasitic diseases, such as intestinal and filarial helminths, can only be prevented through personal protective measures against the infective stages of the parasite and/or through periodic treatment or eradication treatment on return (Antibiotic Expert Group, 2019).

Non-infectious Hazards of Travel

Despite the emphasis on infectious disease in travel medicine, the single most common preventable cause of death amongst travellers is accidental injury (Baker et al., 1992; MacPherson et al., 2007; Prociv, 1995; Steffen, 1991). About 35% of deaths of Australian travellers abroad were the result of ischemic heart disease, with natural causes overall accounting for some 50% of deaths (Prociv, 1995). Trauma accounted for 25% of deaths of Australians abroad (Prociv, 1995) and also for incoming travellers to Australia (Leggat & Wilks, 2009). Injuries were the reported cause of 18% of all deaths, with the major group being motor vehicle accidents, accounting for 7% of all deaths, which appeared to be over-represented in developing countries (Prociv, 1995). A similar pattern of mortality was observed in American (Baker et al., 1992), Canadian (MacPherson et al., 2000), and Swiss (Steffen, 1991) travellers abroad. Deaths of Australian tourists overseas have also resulted from drowning, boating accidents, skiing accidents, bombs, air crashes and electrocution (Prociv, 1995). Homicides, suicides and executions combined accounted for about 8% of all deaths (Prociv, 1995). Most fatal accidents in American and Swiss travellers were traffic or swimming accidents (Baker et al., 1992; Steffen, 1991). Deaths of tourists visiting Australia were similarly found to be due mainly to motor vehicle

accidents and accidental drowning (Leggat & Wilks, 2009). Drowning was also found to be a major cause of death of travellers visiting Australia (Peden et al., 2016). Infectious disease was reported as the cause of death in only 2.4% of Australians who died while travelling abroad (Prociv, 1995).

Issues in Aviation Medicine

Travel medicine and tourist health is also a key component of the activities of many health professionals working in the aviation sector. At present, airline travel is severely curtailed by COVID-19 and airlines are seeking to ensure they employ COVID-19 mitigation measures on all their flights (see *Part V Government and Industry Activity: Creating a Safer Journey: Exploring Emerging Innovations in the Aviation Sector*). This has been a challenging undertaking by airlines and studies are just starting to emerge that there may be some way to go, at least in some regions (Alshahrani et al., 2021).

In addition to undertaking aviation medical examinations and advising their own staff, who are travelling, airline medical departments review passengers' clearances to fly and provide advice to travel health advisers. Some travellers need special clearance to fly in cases of aeromedical evacuation (AME) on commercial aircraft and in certain prescribed circumstances of normal travel, such as with recent surgery or serious physical or mental incapacity (Graham et al., 2005). Liaison by travel health advisers with the airline medical departments is usually also advisable. Health professionals working in the aviation sector also become involved in developing policies and guidelines for dealing with in-flight emergencies involving travellers, as well as training for flight attendants in first aid. Physicians working in aviation medicine have their own national or regional professional organisations, such as the Australasian College of Aerospace Medicine, Australasian Society for Aerospace Medicine, the International Academy of Aviation and Space Medicine and the Aerospace Medicine Association in the United States of America.

While some medical practitioners undertake the work of Designated Aviation Medical Examiners, particularly in respect of pilots, air traffic controllers and, in some instances, flight attendants (Leggat & Putland, 2004), travel health advisers also need to be aware of the potential health effects of modern airline travel, including COVID-19 (Grout & Leggat, 2021). These include the effects of reduced atmospheric pressure, low humidity, closed environment, inactivity, the effects of crossing several time zones on circadian rhythm, alcohol, and the general effects of aircraft motion and movement (Graham et al., 2005). These effects can produce conditions such as barotrauma, dehydration, jet lag, motion sickness, claustrophobia and panic attacks, air rage, spread of infectious disease, and contribute to the development of deep vein thrombosis (DVT) and venous thromboembolism (VTE) (Graham et al., 2005). There have also been concerns raised about the transmission of tuberculosis through close proximity to infected travellers on commercial aircraft (WHO, 2008). The provision of travel health advice and preventive measures for these conditions also largely falls to the travel medicine provider.

While considerable attention has been focussed on DVT and VTE, it remains uncertain what the contribution of air travel is to the development of this condition amongst travellers. What seems to be clear is that the development of DVT and VTE is multifactorial (Mendis et al., 2002). 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 deep vein thrombosis after a long haul flight, which is estimated to be about 1 in 200,000 for travellers on a 12-hour long haul journey (Gallus & Goghlan, 2002). In the meantime, conservative measures should be recommended, such as in-flight exercises, restriction of alcoholic and caffeinated beverages, drinking lots of water. Other preventive measures for some at-risk cases, such as sub-cutaneous heparin, are worthy of investigation (Zuckerman, 2002). 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.

Travel Advisories

In recent times, travel advisories have assumed great importance in endeavouring to secure the safety and security of travellers (see *Part V Government and Industry Activity: Government Travel Advisories*) and indeed have greatly reduced travel globally during the current COVID-19 pandemic. National governments regularly update their travel advisories, which are often included as part of information supplied by computerised databases used in travel medicine. Travellers and tourists can be confronted by a range of threats (see *Introduction: Issues in Tourist Health, Safety and Wellbeing*), including acts of terrorism resulting in numerous casualties, such as the October 12, 2002, bombings in Kuta, Bali, Indonesia, which required a rapid multiagency response to rescue foreign nationals trapped in Bali. This was in the context of under-resourced local health facilities, which were quickly overwhelmed by both local and tourist casualties (Hampson et al., 2002; Leggat & Leggat, 2004).

Travel Insurance

Because of the potentially high costs of medical and dental treatment abroad, which may not be covered by private health insurance or local national health services, and the potential high costs associated with aeromedical evacuation (AME), all travellers should be advised of the need for comprehensive travel insurance. Travel insurance policies normally underwrite travel-related, medical and dental expenses incurred by travellers abroad under conditions specified by the travel insurance policy. In addition, travel insurance companies often provide a direct service, usually through their emergency assistance service contractors, to assist travellers

abroad. This may include assisting with accessing or obtaining medical care while overseas, including AME. Claims for reimbursement of medical and dental expenses abroad made up more than two-thirds of all travel insurance claims in Australia (Leggat et al., 2005a). In that study, almost one in five Australian travellers abroad have been found to use the travel insurer's emergency assistance service (Leggat et al., 2005a).

Travel insurance is the most important safety net for travellers in the event of illness, injury or unforeseen events, and needs to be available in the post-COVID-19 travel environment (Quantum Market Research, 2020). It should be reinforced by travel health advisers. Studies over the past few decades have shown about 60% of GPs in New Zealand (Leggat et al., 1998), 39% of GPs in Australia (Seelan & Leggat, 2003), and 39% of travel clinics worldwide (Hill & Behrens, 1996) usually advise travellers concerning travel insurance. In addition, 54% of GPs in New Zealand also usually advised travellers about ways to find medical assistance abroad, but in the same study only 19% of GPs recommended travel insurance companies as a source of medical assistance while travelling (Leggat et al., 1998). However, it is not known what proportion of travel agents or airlines routinely give advice on travel insurance. A cautionary note is that with *travel bubbles* beginning to open up between countries (Wego Travel, 2021) some insurers are now offering cover for medical expenses or cancellations due to the virus, but none are currently protecting travellers against sudden state border closures or overseas travel bans. The industry recommends that travellers should carefully read the product disclosure statements of each policy, or ask a trusted travel agent for advice (Williams, 2021).

Conclusion

Travel medicine has emerged as a multidisciplinary specialty area catering for what has been an increasing number of travellers worldwide, until the past 12 months and the advent of the COVID-19 pandemic. Travel health advisers, primarily associated with travel clinics and general practice, are engaged in the provision of 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 are also in a key position to liaise with public health authorities on possible imported disease risks, such as the current COVID-19 pandemic. Travel health advisors will also be central to managing travellers in the COVID-19 era, especially in terms of COVID-19 documentation and advice, including vaccination and testing. In terms of risk assessment and provision of preventive measures, accidents, vector-borne diseases, in particular malaria and the arboviral diseases, stand out as major concerns for travellers. However, common problems such as travellers' diarrhoea and respiratory tract infection also need to be addressed. Travel health advisors have many linkages with the aviation sector, especially in terms of fitness to fly and dealing with problems that may arise in travellers due to physiological and psychological stresses of travel. In the face of global terrorism and conflict, travel

advisories have assumed great importance in travellers' planning. Travel insurance remains an important safety net for travellers, which provides coverage for medical and dental treatment abroad as well as an emergency assistance service, which may include AME.

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