

# ESSENTIAL TRAVEL MEDICINE



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# Preface

The discipline of travel medicine continues to develop with established roots and structures worldwide. The necessity for the clinical practice of travel medicine in the prevention of ill health has never been more understood than now, with ever-increasing numbers of people traveling and criss-crossing the world alongside the potential hazards that travelers themselves may be exposed to and also the potential inherent risk to public health and populations internationally as a consequence of travel. Protecting travelers and, concomitantly, communities and populations requires the skill and expertise of travel medicine practitioners whose knowledge base is underpinned by continued professional development. Knowledge and education go hand in hand, with specialist training being an essential element, so enabling best clinical practice in a constantly evolving specialty.

The purpose of this book is to support those studying for a qualification or higher degree in travel medicine, and it is hoped that it will be used alongside and complement travel medicine reference books. This book is designed not only to support postgraduate training in the discipline but also to encourage undergraduate training in travel medicine in the curriculum of multidisciplinary healthcare training programs. It has been written in a style to complement lectures, with easily accessible information on the core topics required to enable the day-to-day clinical practice of travel medicine. Authors from different continents were chosen specifically in order to represent a range of views reflecting clinical practice and training courses that are available in different countries through the world.

It is hoped that this book will become a useful aide for those furthering their knowledge in addition to being a practical guide that will enhance the clinical practice and profile of travel medicine as a specialty. For those new to the growing discipline of travel medicine, an aspiration is that this book will stimulate interest and enthusiasm for the discipline for the next generation of travel medicine practitioners.

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# **SECTION I**

## **Travel medicine**

# **CHAPTER 1**

## **Basic epidemiology of infectious diseases**

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Infectious conditions comprise a substantial portion of texts and guidelines related to travel medicine [1,2]. To prescribe optimal pre-travel advice, preventive measures, and education to travelers, travel health providers must be familiar with basic epidemiologic concepts, and also the epidemiology and geographic distribution of relevant infections. As past experience may predict future risk, a traveler-specific risk assessment allows possible measures, advice, and behavior modification to be appropriately prioritized for each traveler.

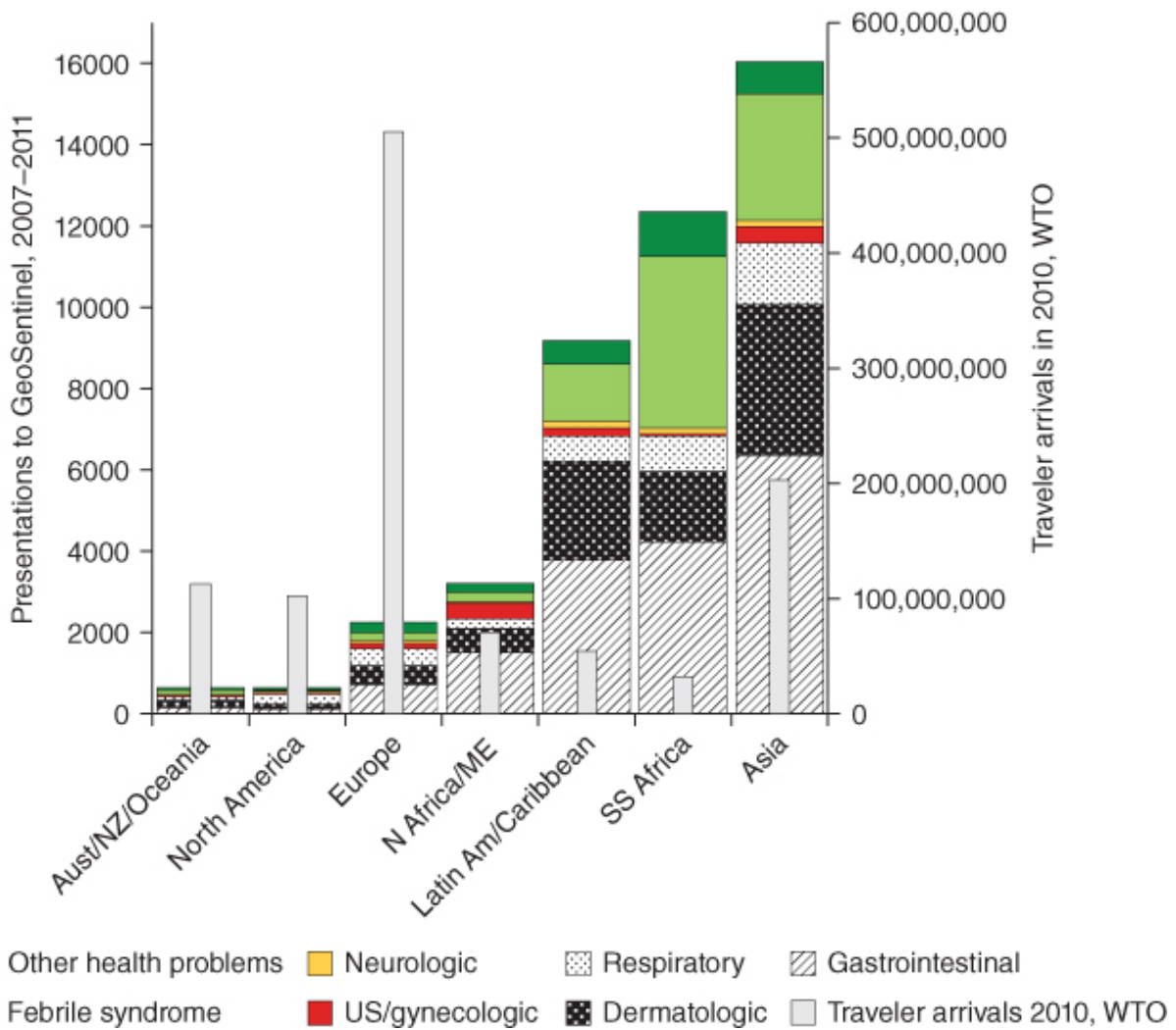
During the past two decades, the most important and relevant data on travel-related disease have come from surveillance of travelers themselves. Although available Ministry of Health data based on people native to an endemic locale may reflect national or state-level trends and identify the most important diseases to monitor within a country, the risk behaviors, eating habits, accommodations, knowledge of preventive measures, and precise itineraries of travelers can differ greatly from those of local populations. The GeoSentinel surveillance system, a collaborative effort between the International Society of Travel Medicine and the US Centers for Disease Control and Prevention, maintains the largest such surveillance

database, with more than 200,000 records from patients with a confirmed or probable travel-related diagnosis. GeoSentinel is a global provider-based network of travel and tropical medicine clinics, which, as of August 2013, has 57 participating clinics on six continents. Details of the standard data collection instrument, diagnostic categories, and patient classification methods used in GeoSentinel have recently been published [3]. The network also facilitates rapid communication, obtains data, and reports on unusual or newly emerging health events in travelers [3].

The most recent surveillance results on travelers published from the GeoSentinel network [4] indicate that Asia (32.6%) and sub-Saharan Africa (26.7%) were the most common regions where illnesses were acquired ([Figure 1.1](#)). Three-quarters of travel-related illness was due to gastrointestinal (34.0%), febrile (23.3%), and dermatologic (19.5%) diseases. Malaria, dengue, enteric fever, spotted-fever group rickettsioses, chikungunya, and non-specific viral syndromes remained the most important of the acute systemic febrile illnesses. Falciparum malaria was mainly acquired in West Africa, and enteric fever was largely contracted on the Indian subcontinent; leptospirosis, scrub typhus, and murine typhus were principally acquired in South-East Asia. More than two-thirds of dengue infections were acquired in Asia, mostly Thailand, Indonesia, and India; seasonality of dengue varies according to destination. Common skin and soft tissue infections, mosquito bites (often infected), and allergic dermatitis remain the most common dermatologic conditions affecting travelers; of the more exotic infections, hookworm-related cutaneous larva migrans, leishmaniasis, myiasis, and tungiasis are the most important. The relative frequency of many diseases varies with both travel destination and reason for travel, with travelers visiting friends and

relatives (VFRs) in their country of origin having both a disproportionately high burden of serious febrile illness (malaria) and very low rates of seeking advice before travel (18.3%). Although the most travel-related illness seen in GeoSentinel clinics comes from Asia, the proportion of travelers who become ill enough to seek specialized care appears to be much higher in travelers returning from Africa or Latin America. Only 40.5% of all ill travelers reported pre-travel medical visits.





**Figure 1.1** Presentations to GeoSentinel by diagnostic category and region (2007-2011), plus 2010 regional WTO traveler arrivals. Left vertical axis shows cumulative number of presentations to GeoSentinel sites by ill returned travelers during 2007-2011 according to syndromic presentation and region of illness acquisition. Right vertical axis (narrow gray bars) shows traveler arrivals in 2010 by region, according to WTO data. WTO, World Tourism Organization; Aust, Australia; NZ, New Zealand, N Africa, North Africa; ME, Middle East; SS Africa, sub-Saharan Africa; GU, genitourinary.

Source: Adapted from Leder et al. 2013 [4].

Regional surveillance networks such as TropNet, a consortium of European centers, have contributed additional information on large numbers of travelers with dengue, schistosomiasis, leishmaniasis, and in particular malaria [5]. Sentinel event detection has led to notifications of outbreaks of travel-related African trypanosomiasis [6], leptospirosis, and malaria that have been indicative of possible changes in destination-specific risk.

Although GeoSentinel and similar traveler surveillance networks offer many advantages over disease-specific studies or data collated at single centers, they have several limitations. The reported cases represent a sentinel convenience sample of ill returned travelers visiting specialist clinics and do not reflect the experience of healthy travelers or those with mild or self-limited illness who visit primary care practices or other healthcare sites. In addition, referral patterns, patient populations, and travel demographic characteristics are not consistent between sites. Although collecting data exclusively from ill patients does not permit absolute or relative risks to be determined, the available data do show the relative frequency and range of illnesses seen in wide samples of travelers.

Estimates of true incidence and true risk in travelers (often expressed as number of events per 100,000 travelers) have been elusive for a number of reasons. Although a number of approaches to measure risk have been discussed in detail [7], such estimates have been limited in terms of obtaining both an accurate numerator (number of cases of disease) and denominator (number of travelers overall or to a specific destination who are susceptible to infection and illness). Many travelers to a specific location who become infected or ill will have returned to their home country by the time they develop signs and symptoms, so will not be captured by surveillance in the country of exposure, even if

reporting is good. Similarly, diseases with short incubation periods may have resolved by the return home and not be captured in the country of origin. A denominator for all travelers to a specific location that could be used to calculate incidence is also generally problematic, and those available are typically estimates provided only at the country or region level and not at the actual destination level [8].

Many of the cited data on incidence of infection in travelers, some of which were published more than three decades ago, are based on extrapolations of small single-site studies or limited data collected from small samples of travelers. Authoritative texts such as the 2014 US CDC Yellow Book [1] often contain tables of global risk estimates that may range from 20–40% of all travelers for travelers' diarrhea to 0.0001% for Japanese encephalitis for all travelers to Asia. Although such numbers are useful as a guide to relative disease risks in large populations, the travel advisor should always seek out the most destination-specific information possible. Unfortunately, for many diseases, such information is only available to the national or, at most, the first geographic administrative level and might apply only to native populations and not to travelers.

A number of factors are important in analyzing epidemiologic data on travel-related diseases or in interpreting published reports. First, the characteristics specific to the disease itself, such as mode of transmission (vector-borne, food-borne, water-borne, environmental exposure), incubation period, signs and symptoms, duration of illness, diagnostic testing, and importance of comorbidities in acquiring and presenting with illness, and clinical outcomes must be considered. Second, the presence, frequency, seasonality, and geographic distribution of the disease need to be assessed, and these might change over time due to outbreaks, emergence or re-

emergence in new areas or populations, successful public health interventions, and other factors. Third, as discussed above, travelers represent a unique subset of individuals, hence their exposure might differ compared with that of residents of a destination country.

As a result, along with demographic characteristics, additional travel-specific variables that must be considered would be trip length, destinations (both current and previous), specific travel itineraries (if known), purpose of travel, and type of traveler; preparation before and behaviors during travel also factor into the epidemiology of travel illnesses. Some but not all of these variables are systematically collected by surveillance systems that either focus on travelers, such as GeoSentinel, or collect data on illnesses that affect travelers. In addition, travelers are a heterogeneous group, and because analyses are always composed of samples rather than entire populations, the sample profile must be carefully examined and disclosed. For example, VFRs have consistently represented higher proportions of serious febrile illness, particularly malaria, among travelers [9,10].

Data on the health characteristics and pre-travel healthcare of travelers are important to provide insight into the itinerary, purpose of travel, or existing medical conditions in order to prioritize the most relevant interventions and education. A US-based provider network, Global TravEpiNet (GTEN), systematically collects data from travelers presenting to a consortium of 26 travel and tropical medicine clinics. Of 13,235 travelers seen from 2009 to 2010 in GTEN clinics, India, South Africa, and China were the most common intended destinations for these travelers, with more than one-third of trips occurring in June, July, and August [11]. Travelers seen in sampled GTEN clinics ranged in age from 1 month to 94 years, with a median of 35 years. The median duration of travel was 14

days, although 22% of travelers pursued trips of >28 days, and 3% of travelers pursued trips of >6 months. About 75% were traveling to malaria-endemic countries; of the 72% who were prescribed an antimalarial, 70% of the prescriptions were for atovaquone/proguanil. Of the 87% of travelers who were prescribed an antibiotic for presumptive self-treatment of travelers' diarrhea, a fluoroquinolone or azithromycin was prescribed in almost equal proportions. Vaccines against hepatitis A and typhoid were the most frequently administered. About 38% of travelers were visiting yellow fever-endemic countries, for which they may need a vaccine requiring a higher level of practitioner knowledge. Immunocompromising conditions, such as HIV infection and AIDS, organ transplant, or receipt of immunocompromising medications, were present in 3% of travelers. Although this is a relatively large multicenter sample, GTEN is limited to a subset of specialized travel and tropical medicine clinics in the United States and does not capture travelers who seek pre-travel care from primary care and other providers, and data have only been collected since 2009.

As travel medicine continues to grow with regard to both number of practitioners and subject matter, infectious diseases will remain an important and perhaps an even greater component of the discipline. Likewise, the epidemiology of infectious diseases in travelers will remain important, with surveillance and reporting potentially being enhanced and refined, resulting in more complete and informative data being available to both clinical and public health practitioners and allowing more informed decisions to be made with regard to protecting the health of the traveler.

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## **CHAPTER 2**

### **Basic epidemiology of non-infectious diseases**

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#### **Introduction**

Travel can be an exciting mix of new experiences, friends, sights, food, and sensations. It can awaken a person's desire for adventure, but unfortunately it can also be fatal, and although most travel medicine focuses on the exotic, the infectious, and the unusual [1,2], it can be everyday activities, such as driving or living with a disease, that are the cause of tragedy. In this chapter, we explore the basic epidemiology of non-infectious disease while traveling, including illnesses due to travel, deaths, and morbidity while traveling, risk and risk factors, common causes of accidents and prevention strategies, the potential risks befalling children and older travelers, and dental problems encountered while traveling.

Establishing a picture of the modern travelers and their destinations is important for aiding our understanding of what types of non-infectious disease conditions may occur and how interventions might take place. This is part of the travel health risk assessment. Although travel medicine focuses on those traveling outside their country, usually abroad, there is a wider role for the travel medicine specialist in providing advice to all types of travelers, including those undertaking recreational activities close to home. Although an underexplored area, there are more people who travel within their country than those who travel to destinations abroad, yet few of these travelers seek advice about keeping themselves healthy and safe.

In this chapter, a broad definition of travel medicine has been used: travel medicine includes all those who travel (no matter what the distance) and who are exposed to a risk that is outside their normal day-to-day routine or where travel is a common part of their work environment that exposes them to risk where a travel medicine specialist would be an appropriate person from whom to seek advice. This would include the older traveler who is traveling with a caravan around their country and not used to traveling long distances, towing a caravan, or visiting sites that have different hazards from those at home such as caves with bats or waterways. It would also include the person who travels for work and is exposed to risky environments, such as divers or truck drivers traveling into areas where there are tropical diseases and hazards, sometimes lurking just below the water's surface.

#### **Why do people travel?**

The number of people traveling continues to grow, with over 1 billion international tourist arrivals in 2012 [3]; however, each person travels for a different reason, and this places each traveler at a different risk of injury or, for example, a cardiovascular event. Broadly, there are five groups of travel scenarios:

- pleasure - leisure, recreation, and holidays;
- visiting friends and relatives (VFR);
- work related;
- religion;
- medical (including dental).



Even within each of these categories there are different groups of travelers; for example, within the work-related group there are those traveling to conferences, those who will be visiting hostile zones, and those working in the aftermath of a disaster or humanitarian crisis, each bringing its own risks. For the more dangerous work-related travel, the people traveling normally have full occupational medical examinations before traveling. Medical tourism continues to grow as the cost of medical care in developed countries increases, and this has its own risk [4]. There is also a subset of travelers who are seeking death (suicide) [5] as opposed to dark travel where the traveler seeks out sites of morbid fascination [6].

There is also a group who cross over between medical tourism and VFR. This group may travel with a chronic condition, such as cancer, and knowing they are unwell and may not have long to live, seek out relatives, friends, or just their country of birth to spend some of their last remaining time [7].

## **Travel pattern?**

Travel patterns in the 20th and 21st centuries have seen dramatic changes in the way people move around the world and the volume of people traveling. In 2012, over half (52%) of all international travel was by air, 40% was by road, 6% by water and 2% by rail [3]. Although the majority of people travel by air, a recent study of people who died while traveling to the United States found that the majority (62%) of deaths were of people undertaking sea travel (predominately cruise ship passengers) (85%) and air travel (38%), with just one death associated with land travel [8]. These deaths were predominately (70%) from cardiovascular causes, followed by infectious disease (12%) and cancer (6%) [8]. Of the 26 deaths from infectious diseases, 19 also had an underlying chronic disease [8].

## **Illness due to travel**

There are a range of illnesses caused by travel itself, with impact from minor illness to death. Conditions include motion sickness, jet lag, deep venous thrombosis (DVT), altitude sickness, sunburn, dehydration, and alcohol toxicity. See [Chapters 3](#) and [24](#).

### **Motion sickness**

Anyone can develop motion sickness if enough stimuli are provided [9]. Motion sickness is caused by the brain receiving conflicting sensory information. Risk factors that increase susceptibility include age, gender, people who get migraine headaches and some medications [9]. Approximately two-thirds of people who suffer from migraines are also sensitive to motion [10].

### **Jet lag**

Jet lag is caused when a person's circadian rhythm is out of synchronization with external time cues [11], caused by traveling across three or more time zones [12]. It is estimated that it takes 1 day for each time zone change for the circadian system to realign; however, there is some variability depending on direction; westward is faster [11]. Common complaints include poor sleep, reduced performance, fatigue during the day, and gastrointestinal disturbances [12]. It is also more common in older people. Long-term consequences can include gastrointestinal problems, increased risk of cancer, infertility, and heart disease [11].

### **Venous thromboembolism**

In a meta-analysis, venous thromboembolism (VTE) has been found to be twice as common among travelers than non-travelers. Traveling for longer periods was also found to increase the risk, with an 18–22% increase for every 2-hour increase in travel duration, and travelers were three times more likely to develop DVT or pulmonary embolism [13]. Other factors that have been identified as increasing the risk include age over 40 years, women using oral contraceptive drugs or hormone replacement therapy, obesity, varicose veins on the lower limbs, and genetic thrombophilia [14]. The incidence ranges from 0.2 to 4.8 per 1 million hours of flying [14].

### **Altitude illness**

Altitude illness (sickness) is an issue of significance as more people take up the challenge of reaching new heights. It can occur when people travel above 2500 m and is divided into three syndromes, the most common being acute mountain sickness (AMS) [15]. In a study of trekkers on Mount Kilimanjaro [16], 3% were AMS positive at 2743 m and 47% at 4730 m. There was no difference between those who took a rest day at 3700 m; however, those who were preacclimatized had a significant reduction in AMS. This is consistent with advice that having exposure prior to moving to higher altitude is valuable; also, it is recommended to avoid alcohol, to ascend slowly at a rate of around 500 m each day after 2700 m, and to plan an extra day of acclimatization for every 1000 m [15]. See also [Chapter 25](#).

### **Death while traveling**

There is no definitive source on how many people die each year while traveling, nor do we know what the risk is of suffering death, illness, or injury while traveling. Estimates of risk vary depending on the country visited and the country of origin ([Table 2.1](#)). Some papers only explore particular types of death, such as injury-related death [17]; it does appear, however, that as more people are traveling so are more travelers dying [18,19].

**Table 2.1** Crude rate of traveler deaths and common causes.

Ref.	Population	Time frame	No. of tourist deaths	No. of tourists	Crude rate per 100,000 visitors	Common causes of death
Leggat and Wilks 2009 [7]	Visitors to Australia	2000-2003	1063	34,396,700 (ABS)	0.77	Ischemic heart disease - 26% Malignant neoplasms - 16% Transport injury - 14% Drowning - 5% Suicide - 3%
Tonellato et al. 2009 [17]	Injury deaths of US travelers	2004-2006	2361	114,627,758	0.69	Vehicle accidents - 33% Violent death - 34% Drowning - 11% Air accident 3% Drug-related 3% Disasters - 2%
Lunetta 2010 [18]	Finnish residents traveling abroad	1969-2007	6894	2005-2007 = 3,163,000	0.75	Natural causes - 67% Injuries - 27%
Redman et al. 2011 [20]	Scottish travelers	2000-2004	572			Trauma - 20% Non-infectious diseases - 7% Infectious diseases - 2%
Lawson et al. 2012 [8]	International travelers arriving in the USA	1 July 2005 to 30 June 2008	213	137,897,860 ( <a href="http://tinet.ita.doc.gov/">http://tinet.ita.doc.gov/</a> )	0.05	Cardiovascular - 70% Infectious diseases - 1% Cancer - 6% Unintentional injury - 4% Intentional injury - 1%

Ref.	Population	Time frame	No. of tourist deaths	No. of tourists	Crude rate per 100,000 visitors	Common causes of death
Pawun et al. 2012 [21]	Visitor to Chiang Mai, Thailand	2010 to 2012	102			Cardiac diseases - 3 Malignant neoplasms - 20% Infectious diseases - 1 Accidents - Suicide - 4% Drug overdoses - 2% Drowning - 1%
MacPherson et al. 2007 [22]	Canadians traveling overseas	1996 to 2004	2410	166,680,000 ( <a href="http://www.statcan.gc.ca">http://www.statcan.gc.ca</a> )	0.95-2.79	Natural - 74 Accidental - 18% Suicide - 4% Homicide 4%

## Morbidity while traveling

Our understanding of morbidity amongst travelers is predominately based on data collected in the 1980s [23] and is commonly acquired from insurance data and returning travelers. Unfortunately, common information about what happens to travelers overseas derived from insurance data often excludes pre-existing medical and dental conditions, as this is not covered under their insurance and the information does not include those not insured. We know from Australian data that a significant proportion of travelers require emergency assistance overseas, including for medical and dental problems, requiring medical or hospital treatment or, in a small number of cases, aero-medical evaluation [24]. Common conditions requiring assistance included musculoskeletal disorders (28%), gastrointestinal disorders (15%), dental conditions (14%), and respiratory problems (12%), demonstrating the significant and immediate impact of non-infectious conditions on travelers [24].

Common claims for non-infectious conditions identified in insurance data include musculoskeletal (16%), dental (7%), and cardiovascular (6%) [25]. A recent study exploring common conditions presenting to GeoSentinel clinics from returning travelers included some information on non-infectious conditions (although we note that infectious diseases make up a significant proportion of what is seen within these clinics) [23]. Common non-infectious conditions seen included underlying chronic disease (19/1000 patients), injury (14/1000 patients), neurologic disorders (15/1000 patients), psychologic disorders (12/1000 patients), and cardiovascular disease (8/1000 patients) and make up a very small number of the cases seen post-travel in GeoSentinel clinics [23]. See also [Chapter 24](#).

## Risks

Depending on the location where one is traveling, one is more likely to die from non-infectious than infectious causes. For example, in Australia between 2001 and 2003, the most common cause of death was from ischemic heart disease, followed by malignant neoplasms, and nearly one-quarter (23%) of the deaths were from accidents predominately related to transport (14% of all deaths) and drowning (5% of all deaths) [7], and US travelers traveling to Mexico were more likely to die from injuries (51%) than any other cause, followed by circulatory diseases (37%), with motor vehicle accidents and drowning being the most common types of injury event [26]. The type of activities in which a person participates also increases his or her risk of being injured or dying; for example, taking part in aquatic activities increases the risk of drowning, and road travel and the type of vehicle used increase the likelihood of being involved in a road traffic incident.

## **Exposure**

Although it is difficult to determine if exposure to travel-related disease differs by gender, the reason why male and female travelers present to travel health advisers does vary, with females more likely to present with diarrhea, irritable bowel syndrome, upper respiratory tract infection, urinary tract infection, psychological stressors, oral and dental conditions, or adverse reactions to medication, whereas males are more likely to have febrile illnesses; vector-borne diseases such as malaria, leishmaniasis, or rickettsioses; sexually transmitted infections; viral hepatitis; or non-infectious problems, including cardiovascular disease, acute mountain sickness, and frostbite [27].

Exposure to travel-related disease is not static and changes depending on the activity that the person is undertaking, the location they are visiting, the time of year, how long they are staying in a particular area, and where they are staying. Much is known about risk and transmission of infectious diseases among travelers, including sexually transmitted infections, although again subpopulations such as adolescents are at greater risk [28]. Overseas travel involving British university students found that they were more likely to drink alcohol, use cannabis, and have casual sex during their holiday [28].

## **Risk taking**

The difference between risk taking and perceived risk in travel is not well understood and is influenced by travelers' existing knowledge, beliefs, socio-cultural background, previous experiences, familiarity, and ability to identify and control risk [29]. It is interesting that perception of risk varies little between pre- and post-travel except for accidents, which increase post-travel; however, risks due to exposure to mosquitoes were perceived to be the highest risk [30]. Some risk taking is expected and is part of the reason why people travel [31]. Risk taking is also influenced by many factors, such as time of year, the activities being undertaken, length of stay, age, gender, and where people stay. For example visiting areas where there is snow in the winter would not only imply the presence of low temperatures and thus possible hypothermia, but also skiing-related injuries and the need for advice about using a helmet [32]. However, during summer trekking may be involved and participants should be aware of body-stressing issues, dehydration, and sunburn. It is also interesting that approximately half of travelers in a recent Australian study have participated in one activity with an injury risk in their last overseas trip, and males and those aged 18-24 years were significantly more likely to participate in at least one activity with an injury risk; common activities included motorcycles and/or off road vehicles (24%), water sports other than swimming (23%), and contact sports (8%) [33]. See also Chapters 3 and 5.

## **High-risk travelers**

There are those travelers who are at a higher risk of being ill or sustaining an injury when traveling, and also those with underlying medical and physical conditions that may worsen while traveling [34]. People who may be at higher risk of being injured include those intending to undertake thrill-seeking or risky activities, sports, going to places where there are known risks such as the “full moon festival” [35], and those who have underlying health conditions that may place them at greater risk of injury or death, such as people with cardiovascular or respiratory conditions who undertake scuba diving or snorkeling [36]. It should also be noted that some high-risk activities are excluded under the terms and conditions of travel insurance policies, hence for those intending to undertake these activities, careful consideration of the policy is recommended.

## **Providing advice to travelers**

The challenge for all travel medicine consultants is to have the difficult conversation around what people may do while traveling – most of the time people are interested in having their vaccinations to protect them against infectious disease and do not want to discuss the things that may kill them! There are a range of risky activities that people undertake when they travel: by far the most dangerous is being on the road, followed by being in, on, or around water, which includes scuba diving, boating, and marine creatures. There are a range of other risky activities where people do need to ensure their safety, including hiking around volcanoes, climbing, caving, canyoning, canoeing, being close to wild animals, and thrill-seeking activities such as sky diving, bungee jumping, climbing glaciers, and snow skiing. Associated with a range of these activities is the use of alcohol and drugs, which can increase the risks of injury and trauma. The experience of trauma can, of course, give rise to a risk of infectious disease by exposing travelers to local hospitals and medical facilities in countries where infection control practices may be suboptimal [33].

### **Road travel**

Road travel is by far the most risky activity that any traveler can undertake; it is estimated that 1.3 million people die each year as a result of road traffic injuries [37]. These incidents involve cars, trucks, buses, motorcycles, bicycles, and pedestrians. This risk increases for travelers who visit countries where people drive on the “wrong” side of the road, and this includes pedestrians [38].

Although much of the advice about road travel is what one would call common knowledge and common sense, and should also be used at home, it is valuable to reiterate the key points: wear a seat belt (including in taxis and buses where fitted) and ensure that children are in a safety seat, adhere to speed limits, take breaks at least every 2 hours on long trips, avoid driving at night, pay close attention to the side of the road you are supposed to be driving on if in a country that drives on the opposite side, avoid alcohol and driving, wear a helmet when riding motorcycles and bicycles, do not text while driving, avoid talking on your mobile phone and driving (it is illegal in many countries, including using hands-free devices), avoid overloaded buses and boats, be alert when crossing the road, practice in a safe area before using a vehicle with which you are unfamiliar, and check about any special local road rules (e.g., “hook turns” in Australia; being on the correct side of the road; knowing what to do when a road train is approaching in the outback) [39]. As a final note, relying too heavily on technology such as navigation systems can also be hazardous, as a recent death in Death Valley, USA, demonstrated [40].

### **Drowning**

Drowning is a significant cause of mortality, with an estimated number of drowning deaths of about 350,000 per annum worldwide [37], although many believe that this is an underestimation as often people are buried without any record and those who drown during flooding, cyclones, typhoons, or other natural disasters are never found [41]. From an exposure perspective, drowning has been found to have a higher fatality rate than road traffic accidents [42], and the drowning death rate in tourists is often higher than that in the local population [19].

Many preventive strategies have been proposed to prevent deaths from drowning, and these strategies vary depending on the age of the person, swimming ability, existing medical conditions, and type of body of water, such as rivers, lakes, or oceans [43]. These preventive strategies may be primary, such as encouraging swimming pool fencing legislation in host countries, secondary, such as the presence of lifeguards or wearing of personal flotation devices (PFDs) (or life jackets), and tertiary, such as learning first aid, including cardiopulmonary resuscitation (CPR) [44]. Restricting a child's access to water via the use of barriers is effective for children under the age of 5 years [45]; however, as they become older this method is less reliable. Supervision either by a parent or by trained personnel such as a life saver or lifeguard can also save a life [45]. The use of PFDs is also valuable, but they need to be worn prior to the event and placed in locations that are easy to access. Being able to swim is not a panacea for preventing drowning, but it does increase one's chances of survival. Also, being unprepared to rescue a family member, particularly a child, has been found to be a notable cause of death and is particularly risky for tourists [46].

Alcohol and drowning are commonly found together in adults [47], and the best advice is to try to avoid any activity that involves water, such as swimming, supervising children, or operating water craft, after consuming alcohol [43]. Swimming between the safety flags, particularly at beaches, is important for all tourists, and wearing of personal flotation devices, even when on boats, can also save lives [48].

## **Scuba diving**

Scuba diving is not without its risks, but they are small. It is estimated that the annual death rate per diver ranges from 0.48 per 100,000 student dives to 1.03 per 100,000 non-course dives, with an annual fatality rate ranging from 3.4 to 71 per 100,000 divers. Common triggers of scuba deaths are gas supply problems, entrapment/entanglement, and equipment troubles. Common disabling agents are emergency descent, insufficient breathing gas, and buoyancy problems. Common causes of death are drowning (~70%), cardiac issues (~13%), arterial gas embolism (~12%), trauma (~4%), decompression sickness (~1%), and marine life (~1%). Risk factors include lack of experience, underlying medical conditions (e.g., cardiac-related and diabetes mellitus), rapid ascent, running out of gas, buoyancy problems, obesity, age, use of helium, and maximum dive depth [49].

Ensuring that a person is medically fit to scuba dive is an important consideration for the travel health adviser, and a diving medical examination or referral to a diving medicine specialist should be undertaken. Unfortunately, many older travelers think that they are able to do what they were doing when they were younger, and a diving medical examination assists in establishing that a traveler is medically fit to dive, which can be a moderately strenuous recreational activity for travelers. In host countries, reminding divers about the basic rules of diving is important, such as never to dive or snorkel alone [43]. A recent Australian study has shown that cardiac-related causes of death are common in snorkelers, followed by drowning, and that 57% of deaths were of people with a known history of cardiac disease [36].

## **Children**

Children represent a vulnerable group, and this can be exacerbated when traveling. Deaths of children who travel are more likely to be from injuries such as in road traffic accidents and by drowning, but the risk of infectious diseases is also present. Deaths from injuries are preventable and not inevitable, and many of the risks faced by children when traveling are the same as when adults travel [50].

Common causes of injury death in children include road traffic accidents (in all types of vehicles, while riding bicycles, and also as a pedestrian), drowning, fires and burns, falls, bites and stings, and poisoning [50]. Prevention strategies include adequate supervision, appropriate seating and use of seat belts in vehicles, wearing a helmet, use of personal flotation devices, swimming in areas where lifeguards are present, avoiding areas with open fires, ensuring that a fire is appropriately extinguished and the area allowed to cool, ensuring that children are not able to leave an area when a supervisory adult is indisposed (e.g., using a chain latch on the door), avoiding animals, and keeping medications and chemicals out of reach. The principles of removing the hazard, placing a barrier between the child and the hazard, supervision, and the use of protective equipment will help to ensure the safety of children.

### **Older travelers**

Although age-related causes of death are a concern for the traveler, there is not a hard-and-fast rule about where this occurs; however, it is clear that older travelers are a vulnerable group when it comes to travel [7,20,22,51]. A recent study [51] exploring the travel-related illness of people over 60 years of age found that compared with a younger age group (18-45 years), they undertook shorter trips, were more likely to undertake organized tours, were less likely to seek medical advice, and were more likely to have chronic diseases. Older travelers are exposed to many of the same risks as their younger counterparts, with some expected differences such as transmission of sexual diseases [51]. The increase in premium tours for mature adults, while providing a safer environment, also results in a number of illnesses and injuries [52,53] and is of concern as these travelers may be less likely to seek prior medical advice.

### **Dental**

Dental problems constitute 7-8% of all claims for travel insurance. Common problems for travelers include pre-existing conditions (26%), particularly those requiring prosthodontic conditions, which are normally rejected by insurers [54]. The most common claims for travelers were those requiring conservative (mostly fillings) (30%), endodontic (mostly root canals) (18%), and prosthodontic (26%) treatment, with a small number of these due to trauma. Females (57%) and those over 60 years of age (52%) were more likely to require dental treatment [25,54]. Travelers should be encouraged to visit their dentist prior to departure. See also [Chapters 3](#) and [18](#).

### **Sand hazards**

Although sand may not be a common hazard that one would normally think about when heading to the beach, there have and continue to be a number of deaths of people who die of asphyxia following entrapment, normally from the collapse of a hole in the sand. A recent study [55] highlighted five cases of teenagers aged 15-19 years who died following the collapse of the holes they were digging. These holes were often 2 m or more deep and represented significant challenges for the extraction and resuscitation of the victims, with sand continuing to fill the holes, the weight of the sand compressing the torso, making breathing difficult, and sand filling the mouth and general airways [55].

### **Volcanoes and glaciers**



Visits to volcanic regions and glaciers are not new; however, as areas that previously would have been available only to adventurers are now available to the tourist, more people are visiting areas where there are potentially significant risks, and volcanoes and glaciers are examples of such areas. For volcanoes, some of the risks include potentially toxic gases (such as carbon dioxide, sulfur dioxide, hydrogen chloride, and methane), seismic activity, lava flows, mudflows, sharp glass-like surfaces, heat, dehydration, and methane explosions [56]. However, although there are deaths associated with visits to volcanoes, it is often the travel to the location that is the most dangerous part [57]. For glaciers, risks of falling, cold, and overuse injuries are common [58].

## Conclusion

Non-infectious causes of death are a common cause of mortality among travelers, with road travel and drowning the most common injury-related causes, followed by cardiovascular disease and cancer. Similarly, common non-infectious causes of morbidity among travelers appear to be related to musculoskeletal problems, including trauma, and to cardiovascular disease and other problems. One of the most significant challenges for the travel health adviser is to convey messages of prevention to a population that is more concerned about exposure to infectious diseases.

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# CHAPTER 3

## Pre-travel health risk assessment

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### Introduction

International travel can expose travelers to a variety of health, safety, and security risks, which can result in illness, injury, or even death in some situations. Up to 75% of travelers to the tropics and subtropics experience various forms of health impairment or use of medication, even if minor [1]. About two-thirds of travel insurance claims are for medical and dental conditions, but a significant proportion are for loss, theft, and muggings [2]. Mortality among travelers depends on the destination, but fortunately remains relatively uncommon. For example, among Swiss travelers, the mortality rate of travelers going to developing countries is about 0.8–1.5 per 100,000 per month [1]. All travelers should be encouraged to seek a pre-travel health consultation, as the proportion of all travelers obtaining this advice from a qualified travel health practitioner remains relatively low [3,4]. The pre-travel health consultation is defined by several elements designed to educate and prevent travel-related illness. The most important aspect of the pre-travel health consultation is a comprehensive risk assessment, which helps to inform the advice and interventions given to the traveler.

# **Defining travel-related risk and the risk assessment**

A risk assessment is undertaken as part of the pre-travel health consultation for those travelers who seek travel health advice prior to departure. It involves evaluating the risks associated with both the destination and the individual traveling to this destination [5]. Travel-related risk in this context has been defined as [6]:

The threat of an adverse event affecting a person's health whilst traveling, which interferes with the trip or necessitates the use of health services.

Generally, risk is evaluated on a gradient from no risk, through to low, medium, and high risk. Most risks, in terms of how they can be addressed, could generally be categorized as preventable, avoidable, manageable, or unexpected [7]. Indeed, in some situations, it may not be possible to address the risks, or not be able to address the risks fully. In undertaking a pre-travel risk assessment, travel health advisers generally focus on the probability of harm and the severity of possible consequences of travel, and balance these with the probability and the severity of possible consequences of any interventions [8]. The purpose of the risk assessment is to help identify travelers at special risk, such as those with underlying medical conditions, pregnant travelers, children or older travelers, and/or those travelers who maybe undertaking travel that has special risks, for example, long-term travelers, adventure travelers, or those undertaking a pilgrimage or going to a high-risk destination [9].

## **Pre-travel health consultation**

As part of the pre-travel consultation, or indeed as part of the during-travel consultation, where the traveler describes his or her itinerary and/or activities, a risk assessment needs to be undertaken, involving evaluation of the risks associated both with the destination and of the individual traveling to this destination. Information on the exact itinerary, including all the destinations to be visited, and particular medical problems of the traveler needs to be obtained in a timely manner, usually 6–8 weeks before travel for most travelers, perhaps longer when travelers are going overseas for long-term employment, placement, or holiday touring. In the clinic setting, although it is preferable that much of this information is obtained well before the traveler presents for their first face-to-face consultation, often this information is elicited at the time of the pre-travel health consultation. It is necessary to establish:

- The traveler's destinations and schedule.
- Which regions the traveler is going to within these countries.
- Activities planned during travel and anticipating likely scenarios for those activities that are not planned.
- Modes of transport.
- Duration of travel.

This information may be obtained by a standardized questionnaire, which may be developed in the context of a travel clinic network, general practice network, or individual travel health advisers. The World Health Organization (WHO) has provided an example of the types of questions to be asked in *International Travel and Health* [5]. Clinic staff can assist by ensuring that this information