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Committee to Advise on Tropical Medicine and Travel

Statement on Older Travellers

Preamble

The Committee to Advise on Tropical Medicine and Travel (CATMAT) provides the Public Health Agency of Canada (PHAC) with ongoing and timely medical, scientific, and public health advice relating to tropical infectious disease and health risks associated with international travel. PHAC acknowledges that the advice and recommendations set out in this statement are based upon the best current available scientific knowledge and medical practices, and is disseminating this document for information purposes to both travellers and the medical community caring for travellers.

Persons administering or using drugs, vaccines, or other products should also be aware of the contents of the product monograph(s) or other similarly approved standards or instructions for use. Recommendations for use and other information set out herein may differ from that set out in the product monograph(s) or other similarly approved standards or instructions for use by the licensed manufacturer(s). Manufacturers have sought approval and provided evidence as to the safety and efficacy of their products only when used in accordance with the product monographs or other similarly approved standards or instructions for use.

Introduction

Definitions

This statement addresses the health needs of our increasing population of older travellers, with or without co-morbidities. Definitions for 'elderly' or 'senior' are not standardized, although 65 years and older is a commonly used indicator. Age, however, is relatively less important than physiologic and disease status and does not necessarily correlate with the presence or absence of co-morbidity. With this in mind, a restrictive definition of 'elderly' or 'senior' will not be used in this statement.

Epidemiology and travel trends

Data on the extent and nature of travel by older adults is limited, but indicate that this group comprises a substantial proportion of all travellers and travels to the full range of destinations including high-risk destinations. In 2008, Canadians over age 65 years accounted for 14% of international travel (to countries other than the USA), while those 55 years and older accounted for 34% of international travel (1). In 2006, 13.7% of Canadians were over the age of 65 years (2). As the population continues to age, with

***Members:** Dr. P.J. Plourde (Chair); Dr. C. Beallor; Dr. A. Boggild; Dr. J. Brophy; Dr. M. Crockett; Dr. W. Ghesquiere; Ms. A. Henteleff; Dr. A. McCarthy; Dr. K. L. McClean
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Member Emeritus: Dr. C. William L. Jeanes
Consultant: Dr. S. Schofield

† This Statement was prepared by Dr. K. L. McClean and approved by CATMAT.

seniors expected to account for almost a quarter of the Canadian population by 2041 (3), older travellers, and especially those with co-morbidities, will present new and more frequent challenges for their physicians and travel health providers.

In addition to an expanding older population, other factors have contributed to increased travel by older members of society. The first wave of baby boomers (those born between 1946 and 1955) are now in their 50s, which increases the Canadian retired population by 500,000 each year. This generation is more educated, has more disposable income, has more available time for leisure and travel, and is more likely to have engaged in international travel earlier in life than preceding generations. The tourism industry anticipates that the over-50 age group will dominate the industry for the next several decades with a doubling of air travel among this group between 1996 and 2016 (4). Aging baby boomers make up a significant proportion of travellers and are also changing the face of senior travel. Identified and anticipated travel trends for this group include: the influence of special interests on travel choices; demand for up-scale travel; health and fitness focus; intergenerational travel; popularity of adventure travel, particularly 'soft' adventure travel (camping, hiking, bird / animal watching); continued popularity of cruises; and waning popularity of motor coach tours (5). Female travellers outnumber male travellers in the senior age range, reflecting the increased life expectancy for women and the fact that women now entering their senior years were more likely to have worked outside the home and have greater disposable income than their predecessors. A report published in 2000 indicates that women make up 65% of the overseas adventure travel market in North America (5). Many Canadians over the age of 65 years take trips of longer duration: in 1998, 13% of overseas (non-USA) trips and 11% of trips to the USA lasted more than one month (3). Increasingly, travel agencies and tour operators cater specifically to the needs of older travellers and cover the full spectrum of travel experiences from conventional tourist destinations to adventure travel in extreme environments.

In 2008, of the 27 million trips abroad made by Canadians, those aged 55 to 64 years took 5.4 million (20.1%), while those over 65 years took 4.0 million (15.0%) (1). Excluding US destinations, those aged 55 to 64 years made 1.7 million overnight trips abroad and those aged 65 years and over made 1.1 million overnight trips abroad. For both age groups travelling to non-US destinations, the most common reasons for travel were recreation (1,960,000 trips), followed by visiting friends and relatives (491,000 trips), and business travel (230,000 trips). The proportion of travel for the purpose of visiting friends and relatives increases with age in travellers above the age of 35 years (1).

Data suggest that seniors are neither deterred from travel by chronic health conditions, nor adequately prepared for the potential need to access health care during travel. A study of travellers over the age of 50 years visiting remote areas in Western Australia reported that the incidence of heart disease and diabetes in these travellers was higher than the Australian national prevalence for 65 to 74 year olds (13.5% vs. 11.3% for heart disease; 8.1% vs. 4.9% for diabetes), while chronic respiratory disease was identified in 6.8% of travellers compared to the Australian national prevalence of 9.3% (6). In this study, few older travellers with chronic illness carried a health summary or a written list of medications, and only half had sufficient medication to last for the entire travel period (6). Among this group of travellers, influenza immunization coverage was below the national Australian average for seniors (6)

The magnitude of risk of adverse consequences of travel for seniors compared to younger travellers is unknown. Many senior travellers are in excellent health and may have minimally increased risk; however, many older travellers will have one or more co-morbid conditions that may affect, or be affected by, travel. In addition to chronic disease, aging itself will affect the ability of the traveller to adapt to conditions of travel. Environmental conditions such as ambient temperature, altitude, humidity, terrain; stressors of travel; and changes in activity levels, diet, and time zones may be less well tolerated among older individuals and,

in particular, among those with just barely compensated chronic illness. Immune responses to vaccination may be suboptimal or delayed, and there may be an increased risk of adverse effects. Many seniors are on multiple prescription medications; therefore, recommendations for standby treatments and malaria prophylaxis must take into account the possibility for drug interactions. Some travel-related illnesses pose a greater risk of developing clinically apparent disease, greater severity of illness, or higher mortality in older travellers compared to their younger counterparts.

Senior Travellers

Physiologic effects of air travel (excluding altitude effects)

Humidity

Most aircraft cabins have low relative humidity (7), which may be as low as 5-10% (8). At relative humidities of 10-20%, dry skin, eyes, and oral mucosa may become minor irritants. More significant for travellers with chronic respiratory disease is the possible drying of bronchial secretions which may lead to difficulty in clearing secretions.

Cramped conditions

Suggested risk factors contributing to the development of venous thromboembolic disease (VTE) in air travellers are cramped conditions in aircraft cabins (particularly in economy class cabins), immobility, hypoxia, low humidity, and dehydration (9;10). The extent to which these factors contribute to VTE risk is unknown and challenging to quantify. It is likely that inherited and acquired thrombophilias / hypercoagulable states play important roles in determining which individuals develop VTE when exposed to flight conditions.

Additional risk factors may be more likely to be present in elderly travellers, particularly the presence of underlying health conditions such as congestive heart failure (CHF), malignancies, and venous insufficiency. Elderly travellers may be at increased risk of dehydration, especially if they are taking diuretics or if they voluntarily reduce oral intake because of concerns about continence or accessibility of toilet facilities.

Cramped seating and prolonged immobility have also been linked to arterial complications with the development of lower limb ischemia and gangrene. Teenan and McKay reported three travellers with peripheral arterial thrombosis following long-haul flights (11). Elderly travellers may be at increased risk of such complications due to the presence of pre-existing arterial disease.

Motion sickness

Motion sickness may be a concern for some elderly travellers who have experienced problems in the past or who are inexperienced with travel. Some lay public information sites for travellers suggest that elderly individuals may have increased susceptibility to motion sickness compared to younger adults (12-14); however, the medical literature is lacking in studies that can help define the relative incidence of motion sickness in older adults. In contrast to the lay literature, a number of professional publications suggest that elderly individuals may be more resistant to motion sickness, but do not provide data in support of this (15;16). Since motion sickness is described as a potential problem for older travellers in the lay literature, older travellers may request advice for prevention or treatment.

Anticholinergic, antidopaminergic and antihistamine medications, with or without sympathomimetic agents to combat drowsiness, are commonly used to treat motion sickness. Older travellers are more likely to be taking drugs with potential interactions or have underlying health issues that are potential contraindications. They also may be more likely to experience adverse effects such as precipitation or deterioration of glaucoma, constipation, urinary retention, and confusion. If an elderly traveller is concerned about motion sickness, the presence of relative or absolute contraindications should be ruled out and a trial of medication should be conducted prior to departure to minimize the risk of unanticipated problems while travelling.

Jet lag and sleep disruption

Older individuals may be more susceptible to the effects of jet lag than younger individuals due to underlying illness, medication, or primary sleep disorders. In one study, seniors reported less sleep disruption following phase delay (eastward travel) than phase advancement (westward travel) (17). There is also evidence to suggest that seniors

recover more slowly from the effects of sleep deprivation than younger individuals in terms of restored sleep, but that they are less affected by sleep deprivation in terms of mood and performance (18). While there is some evidence that sustained-release melatonin preparations may improve sleep maintenance, and short-acting melatonin preparations improve sleep latency in the elderly (19), the evidence is inconsistent. Responses to melatonin are highly variable from person to person, and some users will experience excessive drowsiness. The lack of consistent benefit for melatonin and variable responses suggest that melatonin cannot be uniformly recommended as a means of mitigating the effects of jet lag.

Although benzodiazepines are often prescribed for seniors, there is an increased risk of adverse events, including cognitive and psychomotor impairment, both of which may be potentiated in unfamiliar environments, and may increase the risk of falls and injuries, including motor vehicle collisions. Many seniors are chronic benzodiazepine users and will continue to use them throughout travel. For seniors unaccustomed to benzodiazepines, their first time use during travel cannot be recommended.

Alternative measures to reduce jet lag are non-pharmacologic approaches, such as alcohol and caffeine avoidance (or scheduling caffeine intake to match the destination time); immediate rescheduling of daily activities according to destination time upon arrival; and outdoor light exposure upon arrival at destination.

For more information, refer to CATMAT's *Travel Statement on Jet Lag* (20).

Environmental conditions

Aging increases vulnerability to the adverse effects of both high and low environmental temperatures. Adaptive mechanisms become less efficient with age, and co-morbid conditions may further diminish the ability of these mechanisms to protect against the harmful effects of extreme temperatures. Some medications commonly used by seniors interfere with heat generation or dissipation mechanisms.

Heat exposure

Seniors are at disproportionate risk for non-exertional heatstroke, whereas classic exertional heatstroke is more commonly seen in the context of strenuous physical exertion, usually among younger individuals (21). Unaccustomed physical activity, particularly prior to heat acclimatization, may contribute to the development of heatstroke in senior travellers. Heat acclimatization involves a number of adaptive physiologic mechanisms that include cardiovascular, renal and endocrine systems. Maximal adaptation to heat requires a minimum of several weeks.

Sweating is an important mechanism of heat dissipation. Age-related atrophy of eccrine glands delays onset of sweating and decreases sweat volume, resulting in less efficient heat dissipation. Volume depletion from diuretics and impaired thirst response contribute to decreased sweat production. Salt and water depletion, as well as limited cardiovascular reserves, further diminish heat dissipation by limiting blood flow to skin. Cellular protective mechanisms mediated by heat shock proteins become less effective with aging and increase cellular vulnerability to the adverse effects of heat.

A variety of medications commonly used by the elderly may predispose them to the development of hyperthermia (see Table 1).

Table 1: Medications and their mechanisms of predisposing users to hyperthermia

Medication	Mechanism
Anticholinergics	Decrease sweating, may decrease awareness and voluntary response to heat stress
Antihistamines	Anticholinergic activity Central thermoregulatory effects – decreased afferent input to hypothalamus
Neuroleptics (phenothiazines, thioxanthenes)	
Beta blockers	Interfere with cardiovascular responses to heat stress Limit adaptive heat loss
Calcium channel blockers	
Sympathomimetics / Alpha adrenergic agents (cocaine, amphetamines, ephedrine, pseudoephedrine, caffeine)	Increase heat production Decrease heat dissipation through vasoconstriction
Anticonvulsants	Impaired sweating
Diuretics	Promote dehydration
Opiates	Decrease awareness and voluntary response to heat stress Impaired heat loss
Sedative-hypnotics	
Alcohol	

Senior travellers, particularly those with co-morbidities may be more vulnerable to some complications of heat stroke like acute renal failure, encephalopathy, myocardial infarction, intestinal ischemia and infarction, hepatocellular injury, and acute respiratory distress syndrome. This vulnerability may be attributed to the presence of pre-existing disease and limited reserves of the renal, cardiovascular, cerebrovascular, and pulmonary systems.

Travellers to areas with high ambient temperatures should be assessed for the presence of additional predisposing factors to heat stroke. Information on early warning signs of heat exhaustion and heat stroke, in addition to appropriate preventative measures, should be provided as part of pre-travel counselling.

Cold exposure

The ability to tolerate low environmental temperatures is diminished in older adults. Elderly individuals are more vulnerable to hypothermia and, if hypothermia occurs, to death. Elderly individuals have diminished perception of cold; decreased lean body mass decreases the efficiency of shivering in maintaining core temperature. Elderly patients with underlying cardiac disease may be less tolerant of the myocardial depression, and more susceptible to arrhythmia, resulting from hypothermia. Other complications of hypothermia, including acute renal failure, atelectasis and pneumonia, may be increased in older patients. Peripheral vascular disease and peripheral neuropathy also predispose elderly travellers to frostbite and cutaneous cold injury.

Altitude

Older travellers are less likely than younger individuals to experience acute mountain sickness (22-25), high altitude cerebral edema, and high altitude pulmonary edema (26;27). However, limited cardiopulmonary reserve decreases exercise capacity and predisposes older travellers to hypoxemia and cardiac ischemia at altitude. Optimizing cardio-respiratory fitness prior to travel to altitude and appropriate acclimatization should be emphasized. Travellers with significant underlying sleep disorders, respiratory disease, or cardiac disease may require additional assessment prior to travel and specific

interventions to mitigate the effects of altitude related hypoxia. For further recommendations on altitude and travellers, refer to CATMAT's *Statement on High Altitude Illnesses* (28).

Injury and violence

There is limited, and sometimes conflicting, data on the relative incidence of injury by age, and comparisons between studies are difficult due to differing methodologies. Overall, the incidence of injury is generally higher in travellers compared to the age-matched incidence in non-travellers (29;30). Elderly drivers may be at increased risk of motor vehicle collisions due to slower reaction times and decreased muscle strength. Mild cognitive impairment may create challenges in adapting to a different environment (driving on the left or unfamiliar routes, road conditions, and vehicles). It should not be assumed that an elderly person who is able to drive safely in a familiar setting will be able to safely adapt to driving in an unfamiliar setting. Vehicles may lack, or have dysfunctional, safety features exposing the elderly traveller to a greater risk of severe injury in the event of a collision. Osteoporosis and anticoagulation may also expose individuals (including travellers) to more severe injury.

Elderly people are more vulnerable to falls and are more likely to sustain serious injury in the event of a fall or other trauma. Uneven terrain; absence of or poorly maintained sidewalks; and poorly lit streets, corridors, and stairwells all pose additional risks for falls among the elderly. Travellers with limited mobility or impaired balance should consider taking appropriate walking aids, even if they may not routinely require these at home.

Outside of Canada, rescue and medical facilities may be limited in availability and scope and less able to address the needs of elderly travellers or those with underlying chronic diseases.

There are no data on the incidence of violence towards elderly travellers but they may be at increased risk of personal violence if perceived to be 'easy targets'.

The impact of co-morbid conditions on older travellers

The increasing accessibility of travel, an aging population, and the tourism industry's recognition of older adults as an important market have contributed to new possibilities for travellers with chronic health conditions. Many older travellers will have one or more co-morbidities that may affect their travel experiences or, in turn, that may be affected by the conditions of travel. A study by Tate *et al.* demonstrated that Australian seniors with chronic disease are not less likely to travel and are often poorly prepared for the challenges of managing chronic health conditions and complications while travelling (6). All pre-travel assessment and counselling should include a careful assessment for the presence of chronic health conditions. This is of particular importance for older travellers, in whom the prevalence of underlying health impairment is higher and age-related functional decline constitutes additional risk. Advance planning should be directed at optimizing baseline health status, reducing the risk of complications, and mitigating the impact of travel conditions on the underlying chronic disease.

Immunization of older travellers

A number of special considerations are of importance regarding immunization for senior travellers. Both efficacy and risk of adverse reactions may be affected by age and yet few vaccines have been systematically assessed in the elderly. Data on travel vaccines in the elderly are even more sparse. Declining cell-mediated and humoral immunity influence the response to immunization, potentially resulting in diminished, delayed, and less durable immune responses in the elderly with or without co-morbidities. The elderly may be more susceptible to adverse effects of some vaccines; however, they may also be more vulnerable to disease and complications for some vaccine-preventable illnesses, such as hepatitis A, typhoid fever, and yellow fever.

Age-related waning of immunity to vaccine preventable illnesses

Older adults may have deficient immunity to vaccine preventable diseases covered by routine paediatric immunization protocols like diphtheria, pertussis, tetanus, polio, and rubella (31-35). Also contributing to deficient immunity may be a lack of complete primary immunizations in childhood and failure to keep up with recommended boosters.

In the developed world, disease and death from tetanus occur predominantly in persons over 60 years of age. In Canada, 49% of tetanus cases between 1980 and 2004 occurred in persons over 60 years of age (36). A number of studies have found elderly individuals to be inadequately protected against tetanus. In one survey of rural Belgians, less than 30% of adults over 60 years of age were adequately protected against tetanus based on vaccination history (37). In another study in Belgium, only 49% of hospitalized geriatric patients had protective levels of tetanus antibody (38). A 1995 serologic study of tetanus immunity in the USA demonstrated rapid decreases in the level of immunity beginning at age 40. By age 70, protective levels of immunity were present in only 27.8% of individuals (39). Studies have also shown that in the older adult population, a history of tetanus immunization within the last 10 years is not a reliable surrogate marker of protective levels of immunity (40). Nonetheless, a definite history of three or more previous immunizations is somewhat predictive of immunity (39;41). Canadian seniors are no more likely than American and European seniors to have protective levels of immunity. For example, 45% of seniors assessed in a Toronto emergency room lacked protective immunity to tetanus (41).

Immunity to other vaccine preventable diseases shows similar patterns to that of tetanus with declining immunity to diphtheria and polio with increasing age, and the non-predictive nature of vaccination history (42). In contrast to the situation with tetanus, diphtheria and polio, elderly travellers are more likely to have adequate immunity to measles due to naturally acquired disease in childhood (43).
Diminished efficacy of immunization

Diminished efficacy of immunization

Declining immune function in the elderly may increase the risk of vaccine failure compared to younger individuals. Both cellular and humoral immune responses are known to be affected by age. Decreased efficacy of immunization may be manifested by failure to seroconvert, decreased peak antibody titres, or less durable antibody responses. The correlation of these markers with protection, or lack of protection, is not always clear. Even when peak antibody titres are lower than younger individuals, they may still exceed the 'protective' threshold. Unfortunately, many vaccine efficacy studies exclude, do not recruit sufficient elderly subjects, or do not report immune responses separately for older individuals.

Studies of **hepatitis A** vaccines have shown lower peak titres in older individuals, with antibody titres inversely proportional to age (44). Response to **hepatitis B** vaccination, as measured by anti-hepatitis B surface antigen titres (anti-HBs), decreases with each decade over 40 years of age. Increased age remains a risk factor for inadequate antibody response even when other risk factors for poor response are controlled. In a small study of healthy elderly patients, seroconversion rates to a plasma-derived hepatitis B vaccine (HEVAC B™) were 69% for those in the 7th decade (age 61-70), 44% for those in the 8th decade, and 39% for those in the 9th decade compared to seroconversion rates in young adults of 96% (45). Age greater than 50 years has also been shown to be a risk factor for nonresponse to non-plasma derived hepatitis B vaccines (Engerix B™ or Recombivax™) in health care workers (46). A meta-analysis of 24 published studies of the effect of recombinant hepatitis B vaccine found that the relative risk of vaccine failure for older individuals was 1.76 compared to younger persons (47). This increased risk of failure persisted even when studies assessed as having poor quality were eliminated from the analysis and when adjustments were made for publication bias.

There may be an advantage to giving combined hepatitis A and B vaccine in the elderly compared to monovalent hepatitis B vaccines. A study comparing combined hepatitis A and B vaccine (Twinrix™) to two monovalent hepatitis B vaccines (Gen-HB-Vax™ or Engerix B™) found the highest antibody titres in response to the combined vaccine. This effect is most prominent in adults over 60 years of age (48).

The efficacy of **typhoid** vaccine has predominantly been assessed in young children in endemic areas where repeated exposures may affect the intensity and durability of the immune response. Individuals from non-endemic areas, including elderly travellers, may be at increased risk of infection with *Salmonella typhi* and/or complications from infection. However, the response to immunization with either purified Vi polysaccharide vaccine or Ty21 live-attenuated oral vaccines has not been studied in this group. Compared to other common vaccines, the efficacy of typhoid vaccines is limited in all age groups (49). Protection against enteric fever due to *S. paratyphi* is even more limited (no protection is offered by the capsular polysaccharide Vi vaccine, and protective efficacy for oral Ty21a vaccine is possibly limited) (50;51).

Specific information on the immune response of elderly travellers to **Japanese B encephalitis** vaccines is lacking. Japanese B encephalitis is known to be more severe as age increases with higher morbidity and mortality; however, most vaccine efficacy studies have been conducted in children in endemic countries.

Limited data on the efficacy of the 17D **yellow fever** vaccine in the elderly indicate that neutralizing antibody responses are not diminished in the elderly. Both seroconversion rates and geometric mean antibody titres were unaffected by age, suggesting that efficacy is undiminished in the elderly (52).

The efficacy of two **rabies** vaccines (purified duck embryo vaccine and human diploid cell vaccine) has been shown to decrease with age, but the clinical significance of this is unclear (44).

The efficacy of **pneumococcal** polysaccharide vaccine (PPV) in the elderly has been debated with varying and contradictory results in different studies and inconclusive results of meta-analyses. There is good evidence to support the conclusion that PPV protects against bacteremic pneumococcal pneumonia, yet multiple studies and meta-analyses have failed to show protection against non-bacteremic pneumococcal pneumonia (53). In contrast, a very large cohort study of over 11,000 Spanish subjects 65 years and older followed for 3 years found significant reductions in pneumonia rates and hospitalization for pneumonia, with a 45% reduction in pneumococcal pneumonia and a 59% reduction in risk of death from pneumonia in the vaccinated cohort (54). The pre-travel assessment provides an opportunity to deliver pneumococcal vaccine to adults over 65 years of age who have not yet received the vaccine as part of routine health maintenance activities.

Delayed response to immunization

After receiving the hepatitis A vaccine, 95% to 100% of individuals will develop protective levels of serum antibody against hepatitis A virus within four weeks (36). Recommendations are that vaccination against hepatitis A should be completed by four weeks prior to travel, but this is frequently an unattainable goal and immunization is often not completed until much closer to departure. The possibility of delayed response to immunization in the elderly, combined with potential higher risk of infection and greater severity of infection compared to younger individuals, has important implications for the timing of immunization for elderly travellers without natural immunity.

Adverse events following vaccinations

The elderly typically have lower rates of adverse effects from vaccines with several notable exceptions. Systemic adverse events (SyAE) following yellow fever vaccination include multisystem or neurologic reactions to immunization (excluding anaphylactic reactions). These reactions may be life-threatening. Although the elderly experience lower rates of minor adverse effects from the yellow fever vaccine, concerns about serious SyAE in elderly persons were raised following reports of four cases of multiple organ failure syndrome in yellow fever vaccine recipients aged 63 to 79 years between 1996 and 1998 (55). Reviews of Vaccine Adverse Events Reporting System data from the USA confirmed a higher rate of serious adverse reactions to the yellow fever vaccine in the elderly. Compared to vaccinees aged 25 to 44 years, persons aged 65 to 74 years experienced 5.8 times the rate of serious adverse effects and 3.5 times the rate of hospitalization or death (44). Individuals 75 years of age and over experienced 18 times the risk of serious reactions and 9 times the rates of hospitalization or death compared to those 25 to 44 years of age (44). Serious reactions to yellow fever immunization are classified as yellow fever associated viscerotropic disease (YEL-AVD) and yellow fever associated neurologic disease (YEL-AND).

Available data suggest that these reactions may represent an aberrant host response to immunization that allow for uncontrolled replication of the attenuated virus, rather than reversion of the vaccine-associated virus to a wild type, more virulent strain (56). In addition to age, thymectomy for benign or malignant thymoma has been identified as a probable risk factor for YEL-AVD and YEL-AND. A history of thymoma, thymectomy, or myasthenia gravis is now considered a contraindication to administration of yellow fever vaccine. YEL-AVD and YEL-AND appear to only occur following primary immunization for yellow fever (57).

The decision as to whether an elderly person should be given yellow fever vaccination should be made after a careful review of the risks of exposure and risks of adverse reactions from the vaccine – both of which are difficult to quantify with precision. Since yellow fever is an arthropod-borne infection, all travellers to endemic areas should adhere to the optimal application of personal protective measures (PPM) against mosquitoes. For travellers for whom a medical exemption is recommended, special attention to discussion of PPMs during pre-travel counselling should be provided. For more information on PPMs, refer to CATMAT's *Statement on Personal Protective Measures to Prevent Arthropod Bites – Update* (58).

If yellow fever vaccination is being considered only to comply with entry requirements at destination or transit countries (in the absence of risk of transmission), individuals over 60 years should be provided with an exemption certificate. If the traveller is visiting a yellow fever endemic location where the actual risk of exposure is very low, the risks of adverse events from vaccination may be greater than the risk of yellow fever. Accurate and detailed travel plans and up-to-date, region-specific information on yellow fever incidence are necessary to help refine risk assessment; unfortunately, sufficiently detailed information is often lacking. Since transmission of yellow fever in South America is confined to rural / jungle areas, a short trip to urban areas may not require vaccination, particularly if travellers will comply with insect avoidance precautions and are unlikely to change their itinerary. The peak transmission season for yellow fever is at the end of the rainy season and the beginning of dry season (January to March in Brazil, July to October in West Africa). In Africa, yellow fever risk is about 10 fold greater than South America (59) and transmission can occur in both urban and sylvatic (rural) environments, making it more difficult to identify a subset of travellers at low risk of exposure.

Table 2: Yellow Fever Risk Estimates for unvaccinated individuals based on geographic exposure

Exposure	Illness risk	Death risk
Africa: No disease activity	1.2-2.4 / 1,000	0.2-0.5 / 1,000 (60)
Africa: Epidemic activity, 2 week trip	1 / 267	1 / 1,333 (61)
West Africa: 2 week exposure*	50 / 100,000	10 / 100,000 (62)
South America: 2 week exposure*	5 / 100,000	1 / 100,000 (62)
United States travellers 1996-2004 to endemic areas	0.05-0.5 per 100,000 (60)	

*The risk is reported as annual risk. Transmission occurs mainly during a two to four month transmission season, meaning that the risk may be even greater during high transmission season.

Table 3: Risk of serious adverse events following immunization with yellow fever vaccine (62)

Adverse Event	Risk
YEL-AND – all ages	0.8 / 100,000 doses
YEL-AND – persons 60-69 years	1.6 / 100,000 doses
YEL-AND – persons ≥ 70 years	2.3 / 100,000 doses
YEL-AVD – all ages	0.4 / 100,000 doses
YEL-AVD – persons 60-69 years	1.0 / 100,000 doses
YEL-AVD – persons ≥ 70 years	2.3 / 100,000 doses

Table 4: Yellow fever vaccine-associated serious adverse events by age* (63)

Age group	Risk
50-59 years	1.9 / 100,000
60-69 years	4.2 / 100,000
>70 years	7.5 / 100,000

*Serious adverse events include death, life threatening illness, hospitalization, prolongation of existing hospitalization, or persistent / significant disability.

While the information in Table 2, Table 3 and Table 4 provides a general approximation of risk, it must be recognized that these are estimates and do not take into consideration all variables and regional differences in transmission risks. When providing exemption certificates, the duration of validity of the exemption should be restricted to the duration of the trip unless there are absolute contraindications to yellow fever vaccine. Future travel, potentially even to the same area, may have different risk-benefit conclusions.

Meningococcal vaccination

Although the quadrivalent polysaccharide conjugate vaccine (Menactra) vaccine is not licensed for use in adults over 55 years, many senior travellers need adequate protection against meningococcal serotypes other than C. Menactra use on an off-label basis is appropriate for these individuals (64). For more information on meningococcal vaccine, see the CATMAT *Statement on Meningococcal Vaccination for Travellers* (64).

Influenza vaccination

Influenza has long been recognized as an important cause of morbidity and mortality in older adults, with elderly individuals being at highest risk for influenza-related mortality. Studies evaluating the benefit of influenza vaccination in the elderly have yielded disparate results from marginal to substantial benefit (65).

Goodwin *et al*. analysed studies from 1986 to 2002 of antibody response to influenza vaccines (including whole virus, split virus, and sub-unit vaccines). They found that those 65 years and older had significantly lower antibody responses to the influenza vaccine than younger adults and those over 75 years had the lowest responses in terms of seroconversion, seroprotection, and geometric mean antibody titres (65).

In addition to the diminished response to influenza immunization, it has been suggested that antibody titres decline rapidly in the elderly, reaching subprotective levels within four months post-immunization. Historically, both the American Advisory Committee on Immunization Practices (ACIP) and the Canadian National Advisory Committee on Immunization (NACI) have included cautions against immunizing the elderly too early in the influenza season (66;67). This would be particularly relevant to elderly travellers who are immunized at the onset of influenza season in northern countries and travel in late winter or the following summer. However, the evidence to support a rapid decline in antibody titres is sparse. A recent literature review by Skowronski et al. found that if seroprotection was achieved, it was maintained in 70 to 100% of individuals at four months. Seroprotection rates were maintained for over six months in several of the studies included in the review, and one study demonstrated ongoing protection for one year (68). Skowronski's reviews suggest that elderly travellers, who have been immunized at the beginning of the influenza season and are planning travel late in the season, are unlikely to benefit from a second 'booster' dose of influenza vaccine.

In discussion of influenza prevention it is important to consider that the influenza season in the southern hemisphere is opposite to that of the northern hemisphere and occurs year-round in the tropics. Elderly persons, who did not receive influenza vaccine at the beginning of the influenza season and are now planning travel, should be encouraged to have the vaccine pre-departure if vaccine is still available. Ideally, the vaccine should be administered four to six weeks prior to departure to ensure adequate time for antibody development prior to travel. If vaccine is no longer available, or if there is substantial mismatch between the northern hemisphere vaccine and influenza strains circulating at the destination, high risk travellers may wish to consider seeking vaccination upon arrival, particularly if a long stay is anticipated. For short trips, it remains questionable whether adequate antibody responses can be achieved in time to offer significant protection.

The lack of specific information regarding the responses of elderly individuals to travel vaccines is of concern. Not only does this population account for a significant number of travellers, which is anticipated to increase substantially in the future, more elderly persons are travelling to regions of higher risk. Overall, the evidence suggests that elderly persons may have a lower response rate to most vaccines with decreased seroconversion rates, slower development of protective levels of antibodies, and less durable responses. In light of the delayed response to hepatitis A vaccination and the lack of data for other vaccines, initiating pre-travel immunizations earlier than for younger travellers may be a prudent, though not always possible, strategy. Travellers' diarrhea in the elderly

Travellers' diarrhea in the elderly

Studies from the Caribbean, South America and Africa have shown the risk of travellers' diarrhea to be higher in younger travellers with increased attack rates in those under 35 years of age (69-71). A study of risk factors for travellers' diarrhea in Peru showed increased risk in those under 35 years of age (72). A recent prospective study assessing risk behaviours of elderly travellers compared to younger travellers showed significant differences in the eating and drinking behaviours of those over age 60 years compared to those aged 20 to 30 years, with younger travellers more likely to eat food from street vendors and consume tap water or open drinks (73). The risk of diarrhea was significantly higher in the young adult group (73).

While old age has not been associated with an increased risk of travellers' diarrhea, elderly individuals are predisposed to a number of conditions associated with increased risk for acquisition of infection, more severe disease, or complications. Reduced gastric acidity (from acid suppression therapy or disease) is common in the elderly and is associated with increased risk of infectious diarrhea. Declining immune function, impaired gastrointestinal (GI) motility, and coexisting GI tract abnormalities may also contribute to risk of infection or complications. Age-related blunting of thirst mechanisms and use of diuretics may predispose the elderly to greater risk of dehydration and electrolyte abnormalities if they develop travellers' diarrhea. Underlying cardiac, renal, or GI diseases will increase the risk of complications, such as coronary insufficiency and deterioration of renal function, in the event of dehydration and electrolyte imbalance.

Little data is available regarding the overall risk and spectrum of pathogens responsible for travellers' diarrhea specifically in elderly travellers, but they would be expected to be at risk for the full spectrum of pathogens relevant to younger travellers and may be at increased risk for some pathogens. Bacterial pathogens are the most commonly identified causes of travellers' diarrhea, typically accounting for about half of cases with confirmed microbial etiology. Enterotoxigenic *E. coli* heads the list, followed by other bacterial pathogens including *Shigella, Campylobacter, Salmonella* species, and other pathogenic strains of *E. coli*. Adults over the age of 50 years infected with non-typhoidal *Salmonella* are at increased risk for bacteremia and consequent metastatic infections like mycotic aneurysms, vascular graft infections, and infections of prosthetic devices, such as heart valves or joints.

Microsporidium is primarily recognized as an opportunistic pathogen in AIDS patients, but has been occasionally identified in travellers with diarrhea (74;75). Underdiagnosis of this pathogen as a cause of diarrhea may be significant due to the limitations of diagnosis by light and electron microscopy. A Spanish study demonstrated microsporidium as a cause of acute and chronic diarrhea in elderly individuals without HIV infection (76).

Elderly individuals may be at increased risk of infection with *Cryptosporidium parvum* based on studies conducted during a waterborne outbreak in Minnesota. Elderly individuals demonstrated higher rates of emergency room visits for gastrointestinal illness; shorter incubation periods; and evidence of higher risk of secondary person-to-person transmission than other age groups, suggesting both increased susceptibility to infection and more serious disease (77).

The lack of evidence for a significant increase in susceptibility to travellers' diarrhea for 'well elderly' and the high efficacy of early treatment suggest that antimicrobial prophylaxis for travellers' diarrhea in the elderly should not be routine. A lower threshold for recommending antimicrobial prophylaxis for elderly travellers may be appropriate, but there is no evidence of benefit for recommending prophylaxis based solely on age. For healthy elderly travellers, routine measures should be recommended (for example, food and beverage precautions; prompt initiation of measures to avoid dehydration and electrolyte imbalance; and use of pre-emptive treatment with loperamide, bismuth subsalicylate, and antibiotics) as per CATMAT's *Statement on Travellers' Diarrhea* (78). Antibiotic prophylaxis should be considered for travellers with hypochlorhydria from any cause and for those with chronic illnesses, such as insulin dependent diabetes, chronic renal insufficiency, congestive heart failure, and inflammatory bowel disease. Antibiotic prophylaxis should also be considered for older travellers to high-risk destinations who also have underlying predisposition to the serious complications of *Salmonella* bacteremia (aortic aneurysm, prosthetic heart valves or joints, vascular grafts).

When recommending antimicrobial prophylaxis or standby treatment, potential drug interactions must be considered. Quinolones and newer macrolides are the most commonly recommended agents for both prevention and standby treatment. Of primary concern is the interaction between warfarin and antibiotics, which may result in excessive anticoagulation. Both quinolones and macrolides have been associated with excessive prolongation of clotting times when given with warfarin. Rifaximin is a nonabsorbable semisynthetic derivative of rifamycin that has been shown to have protective efficacy of 77% against travellers' diarrhea when used prophylactically (79). Rifaximin has been recommended for prevention of travellers' diarrhea (80;81) but is not currently available in Canada. It has several significant advantages for use in prevention of travellers' diarrhea in the older traveller: a good safety profile due to its minimal systemic absorption; minimal impact on gut flora with short-term use (82); lack of resistance in pathogens with existing quinolone resistance (83); and, importantly, lack of drug interactions including with warfarin.

Dukoral™ is a whole-cell inactivated oral cholera and enterotoxigenic *Escherichia coli* (ETEC) vaccine promoted for prevention of travellers' diarrhea. It has been administered to individuals over 65 years of age, but no data is available on the protective efficacy of the vaccine in this age group. In the non-elderly population, efficacy of this vaccine against travellers' diarrhea is limited and protection is of short duration (84). While there is some potential for the elderly to receive enhanced benefit from this vaccine because of increased risk, existing data do not provide support for a recommendation for or against its use in the prevention of travellers' diarrhea.

Malaria in the elderly

While pregnant women and young children are well recognized as key groups at increased risk for symptomatic malaria, severe malaria, and death, the elderly have received limited attention from investigators. However, several studies provide evidence that elderly persons should also be regarded as an "at-risk group" for complicated malaria. Review of surveillance data from TropNetEurop and Surveillance Importierter Infektionen in Deutschland (SIMPID) databases revealed increased mortality, cerebral complications, severe disease, and hospitalization with each decade between ages 60 and 80 years (85). A retrospective study of 134 cases of falciparum malaria assessing age as a risk factor for malaria complications found the overall risk of complications in adults older than 15 years to be 37.1% compared to 61.5% in those aged 60 and over (86). An Israeli study of 135 travellers with falciparum malaria also showed increased risk of severe disease and death in older adults aged 40 years and older with an odds ratio of 4.29 (95% confidence interval is [1.25,14.74]) compared to those under the age of 40 years. In this study, older travellers were less likely to have used prophylaxis, but the increased risk associated with age remained even with correction for use of prophylaxis (odds ratio of 3.4, 95% confidence interval is [0.83, 13.98]) (87). A large Italian study of 1,941 imported cases of malaria showed an increasing mortality rate with increasing age; the highest mortality (5%) was reported in patients over 51 years of age (88).

A small retrospective study of falciparum malaria in elderly non-immune travellers from Denmark demonstrated higher parasitemias compared to younger travellers though there were no significant differences in time to diagnosis or use of chemoprophylaxis between the two groups; duration of hospitalization was also longer in the elderly (89).

While limited, the available evidence indicates that the non-immune elderly traveller is at increased risk of severe, complicated, and fatal malaria. Optimal chemoprophylaxis and rigorous application of PPMs must be emphasized; however, the presence of chronic health conditions and medication use may limit chemoprophylactic options for the elderly.

A recent prospective study comparing risk behaviours of older versus younger Israeli travellers showed significant differences in adherence to malaria chemoprophylaxis and use of mosquito repellents (bed net use was not reported). Travellers over 60 years of age were significantly more likely to be fully compliant with their antimalarial regimen than those 20 to 30 years of age (60.7% vs. 33.8%, $p < 0.01$) (73). However, older travellers were significantly less likely to be aware of potential side effects of antimalarials (7.1% vs. 29%, p=005) and to use insect repellents compared to traveller's 20 to 30 years of age (46.6% vs. 60% p= 0.005) (73). These results suggest the need for additional attention to adverse effects and PPMs in pre-travel counselling.

Malaria chemoprophyaxis drugs in the elderly

Doxycycline

The potential for doxycycline to cause esophageal ulcerations through retention of the tablets or capsules in the lower esophagus is well recognized and is the basis for recommendations to take doxycycline with an adequate amount of liquid and to remain upright for 30 to 60 minutes after each dose. This advice is especially important in the elderly who may be more susceptible to doxycycline-related esophageal ulceration as a result of age-related decrease in saliva production and esophageal dysmotility. Tablets are less likely to be retained in the esophagus compared to gelatin capsules (90) and therefore may be a preferred formulation in the elderly. A doxycycline base (compared to hydrochloride) is also less likely to cause esophageal injury. Other reported risk factors for doxycycline-induced esophageal injury include hiatus hernia, left atrial enlargement, and other causes of extrinsic compression of the esophagus (91). Since serum levels of doxycycline may be 50 to 100% higher in elderly individuals compared to young and middle-aged individuals, with tissue levels correspondingly higher (92), extra precautions to limit sun exposure are appropriate. Doxycycline should generally not be co-administered with digoxin unless blood levels can be monitored because some individuals will have increased digoxin levels and risk of toxicity.

Mefloquine

There is a lack of specific data on mefloquine tolerability in the elderly. One potential concern is the risk of cardiotoxicity, primarily risk of corrected QT interval (QTc) prolongation. This concern is based on the occurrence of torsade in the context of co-administration of halofantrine and mefloquine in which the interaction of halofantrine and mefloquine appears to be an important factor in QTc prolongation (93-95). Halofantrine has since been withdrawn from the world market (96). In contrast, mefloquine by itself has minimal to no effect on QT interval and is one of the safer drugs (with respect to torsade risk) for treatment of malaria (97;98).

The use of mefloquine in the presence of cardiac conduction abnormalities and concurrent use of Type I antiarrhythmics (quinidine, disopyramide, procainamide) or type III antiarrhythmics (amiodarone, dofetilide, sotalol), which have significant QTc effects is not recommended. Caution is often advised if mefloquine is used concurrently with other drugs having the potential to increase the QTc (antipsychotics, antidepressants, calcium channel blockers, betablockers, macrolides, azoles, etc.) (95). However, the risk of adverse effects is theoretical, and there is a lack of data to firmly establish a risk of clinically significant adverse effects. In the elderly, multiple factors affecting QT interval may be present and contribute to overall risk of adverse events. A study by Letsas et al. showed that age, along with female gender, hypertension, and paroxysmal atrial tachycardias, were important risk factors for drug-induced QTc prolongation (99). Additionally, age is associated with proportionally greater prolongation of QT in the presence of some drugs (100). Unfortunately, the ability to predict which individuals will experience clinically significant prolongation of QT interval is poor (101). It is not unusual for elderly travellers to be prescribed multiple drugs with potential to prolong QTc interval, including antipsychotics, tricyclic antidepressants, and antibiotics like quinolones or macrolides (often prescribed for standby antibiotic therapy). Although the risk of using mefloquine in an elderly traveller with multiple risk factors for prolonged QTc is not clearly established, where multiple risk factors for prolonged QTc coincide in an elderly traveller, an alternative antimalarial may be preferable.

Chloroquine

Chloroquine cardiotoxicity has been described in the literature, but is largely a phenomenon of long-term chloroquine use in the context of rheumatic or dermatologic conditions (102). Chloroquine has negative inotropic effects, as well as causing some QTc prolongation, but these effects are minimal at therapeutic doses and are unlikely to be a concern for short-term malaria prophylaxis (97).

Atovaquone / proguanil

There is limited data on use of atovaquone / proguanil (Malarone™) in the elderly. A small, single dose study comparing elderly and young adults showed that the elderly had increased systemic availability (that is, a higher area under the curve and longer half life) for cycloguanil (a proguanil metabolite), but no recommendation was made for atovaquone/proguanil dose adjustment in the healthy elderly (103). To date there have been no reported clinical studies of the efficacy and tolerability of atovaquone / proguanil in the elderly. Given the increased risk of renal insufficiency due to age and disease-related decline in renal function in the elderly, it would be appropriate to check renal function prior to prescribing atovaquone / proguanil. If creatinine clearance is below 30 ml per minute, atovaquone / proguanil is contraindicated but no dose reduction is needed for mild to moderate reductions in creatinine clearance (103).

Drug interactions

The elderly are often taking multiple medications, and the risk of adverse drug interactions with the addition of anti-malarial agents is significant. A full review of the traveller's medication list for drug interactions is essential. Warfarin interactions are common, potentially serious, and may pose significant challenges for the travel health advisor, especially for travellers going to resource-limited or remote areas where access to monitoring may be unreliable. Self-monitoring using a portable device is possible, but devices are larger, more expensive, and more complex than glucose monitoring devices. This would be a practical alternative only for a small subset of travellers, particularly those moving to remote areas for long term stays. Both doxycycline and proguanil increase the anticoagulant activity of warfarin. Mefloquine and chloroquine are not known to interact with warfarin. If neither mefloquine nor chloroquine are appropriate choices for malaria chemoprophylaxis, the traveller should

be encouraged to select an itinerary that offers reliable INR (International Normalized Ratio) monitoring. For short-term travel or travel in which monitoring of INR is unlikely to be reliably available, early initiation of the antimalarial with monitoring and dose adjustment of the warfarin prior to departure may be necessary.

Clinicians caring for returned elderly travellers need to be alert to the possibility of malaria and maintain a high index of suspicion to ensure prompt detection of malaria, especially when superimposed on chronic illness that may affect the presentation, or be exacerbated by malaria.

Conclusion

Pre-travel assessment of older travellers requires attention to the issues relevant to younger adult travellers as well as a careful exploration of the traveller's current health status and risk factors. Additional travel preparation time may be required to assess functional capacity, to optimize chronic health conditions, to allow for optimal development of immunity post vaccination as well as to arrange for any special needs during travel. Older travellers should plan early and leave adequate time to complete appropriate pre-travel assessments and preparations. For travellers with significant underlying health issues, collaboration between the travel health provider and the traveller's personal physician is important to optimize both control of medical conditions prior to departure and compatibility of travel recommendations with ongoing health management.

Recommendations

Recommendations	Evidence Based Medicine (EBM) Rating[104]
Older travellers should seek pre-travel advice early to allow for appropriate pre-travel assessments, address any active health issues, and make any necessary special preparations.	BIII
Travel health providers should undertake a careful review of the senior traveller's health status and medications as part of their pre-travel assessment and should collaborate with the traveller's usual physician(s) in planning recommendations.	BIII
Chronic health conditions should be under optimal control prior to travel.	BIII
Motion sickness:	
1. Pharmacologic interventions to prevent motion sickness should generally be avoided in the elderly due to significant risks of adverse events; due to this group taking drugs with potential interactions; and/or due to this group having underlying health issues that are potential contraindications.	CIII
2. If an elderly traveller is insistent on use of pharmacologic approaches to prevent motion sickness, screen carefully for contraindications and consider a trial of therapy prior to travel.	DII
Jet Lag:	
1. Melatonin cannot be routinely recommended as a means of mitigating the effects of jet lag because of lack of evidence of benefit.	CII
2. Benzodiazepines should not be used as a treatment for jet lag related sleep disruption due to increased risk of adverse effects in the elderly, especially for first-time users.	DII
3. Non-pharmacologic approaches to jet lag reduction may be recommended:	CIII
a. Avoid alcohol and caffeine (or schedule caffeine intake to match the destination time).	CIII
b. Immediate rescheduling of daily activities according to destination time upon arrival.	CIII
c. Outdoor light exposure upon arrival at destination.	
Heat stress:	
1. Travellers to areas with high ambient temperatures should be assessed for the presence of additional predisposing factors to heat stroke.	CIII
2. Information on early warning signs of heat exhaustion / heat stroke and appropriate preventative measures should be provided as part of pre-travel counselling.	CIII
3. Elderly travellers intending to engage in vigorous physical activity should plan their itinerary to accommodate appropriate time for heat acclimatization.	CIII
Cold stress:	
1. Travellers to areas with low ambient temperatures should be advised of the added risks of hypothermia or cutaneous cold injury related to age.	CIII
2. Information on early warning signs of hypothermia and cutaneous injury and appropriate preventative / treatment measures should be provided as part of pre- travel counselling.	CIII

Recommendations	Evidence Based Medicine (EBM) Rating[104]
Altitude:	
1. Optimize cardio-respiratory fitness prior to travel to high altitudes.	CIII
2. Travellers with significant underlying cardiac or respiratory disease may require additional assessment prior to travel to high altitudes with consideration given to the need for supplemental oxygen.	CIII
3. Appropriate acclimatization with gradual ascent and mild exercise (avoid overexertion) should be emphasized.	BIII
4. Avoid alcohol and sedative-hypnotics at high altitudes.	DIII
Injury and Violence:	
1. Elderly travellers who intend to drive while travelling abroad should be aware of the potential for unfamiliar conditions to negatively impact driving safety and skills. Alternative safer modes of transportation should be considered for those who may not be able to successfully compensate.	CIII
2. Older travellers with limited mobility and/or balance impairment should be aware of the risk of falls and consider the use of a walking aid.	CIII
Elderly travellers and immunizations:	
1. Review the traveller's immunization history for routine vaccine preventable illnesses: tetanus, diphtheria, polio, mumps and measles.	BIII
i. If vaccination history is uncertain, and time permits, serology to confirm immunity may be considered.	CIII
ii. Elderly travellers who did not receive a primary series should complete this prior to travel.	AIII
iii. Boosters should be provided as indicated to those with previously completed primary series.	AIII
2. Pre-travel immunizations should be completed at least one month prior to travel.	CIII
3. Elderly travellers should receive influenza vaccination according to the annual recommendations of NACI and the CATMAT/NACI *Statement on Travel, Influenza and Prevention*[105].	AI
i. Elderly travellers who did not receive seasonal influenza vaccination at the beginning of the influenza season should be offered vaccination prior to departure.	BII
ii. Pre-departure influenza immunization should be done 4-6 weeks prior to departure to allow sufficient time for optimal antibody response.	BII
iii. Boosting of the influenza vaccine is not required for immunized travellers going to the tropics or southern hemisphere late in the northern hemisphere influenza season.	BII
iv. If influenza vaccine is unavailable prior to departure or the northern hemisphere vaccine is poorly matched to influenza strains circulating at the destination, elderly travellers may consider seeking influenza immunization upon arrival at destination, particularly for longer stays.	BII
4. Travellers over 65 years of age who have not yet received the pneumococcal vaccine should be immunized prior to travel.	AII
5. Immunization recommendations for travel vaccines should follow established guidelines, but travellers and practitioners should be aware of the risk of suboptimal responses. Travezllers should use all appropriate non-vaccine preventative measures to minimize risk.	CIII

Recommendations	Evidence Based Medicine (EBM) Rating[104]
6. Yellow fever vaccine recommendations:	
i. Travellers over 60 years of age who are not travelling into yellow fever endemic zones, but require a certificate of vaccination to enter a destination country, should be provided with a yellow fever exemption certificate.	AIII
ii. Travellers over 60 years of age who will enter a yellow fever endemic zone should have a thorough risk-benefit assessment considering risks of exposure and disease as well as risk of adverse vaccine reactions. The decision to vaccinate or provide a medical exemption certificate should be based on informed decision making with the traveller.	CIII
iii. Travellers with a history of thymus disease, thymoma, thymectomy, or myasthenia gravis should not receive yellow fever vaccine.	DII
iv. Travellers with a history of thymus disease, thymoma, thymectomy, or myasthenia gravis intending to travel to a yellow fever endemic area with active transmission of yellow fever should be counselled regarding risks of infection and encouraged to consider a lower risk itinerary.	CIII
v. Travellers entering a yellow fever endemic zone who are granted a waiver should be counselled regarding optimal use of personal protective measures against arthropod bites.	CIII
7. The quadrivalent polysaccharide conjugate vaccine (Menactra) may be used on an off-label basis for travellers over 55 years who will be travelling to meningococcal risk areas.	CIII
Travellers' diarrhea in elderly travellers:	
1. Elderly travellers should be carefully assessed for additional risk factors for, and complications of, travellers' diarrhea.	CIII
2. Antibiotic prophylaxis for travellers' diarrhea is not recommended for elderly travellers in the absence of additional risk factors.	CIII
3. For older travellers using acid suppression therapy (H2 blockers or proton pump inhibitors), reassess the need for ongoing therapy while travelling. Consider discontinuing acid suppression therapy if the traveller's condition permits.	CIII
4. Antibiotic prophylaxis for travellers' diarrhea should be considered for travellers with hypochlorhydria and chronic illnesses, such as insulin-dependent diabetes, chronic renal insufficiency, congestive heart failure, and inflammatory bowel disease.	CIII
5. Elderly travellers at increased risk for complications from Salmonella infection (aortic aneurysm, prosthetic heart valves or joints and vascular grafts), who are travelling to high-risk areas, should consider use of antibiotic prophylaxis with an agent likely to be active against Salmonella.	CIII
6. Elderly travellers taking warfarin should not use antibiotics for prophylaxis or unsupervised treatment because of the potential for excessive anticoagulation and bleeding.	BIII
7. There is insufficient data to support a recommendation for or against use of Dukoral™ in elderly travelers.	CIII
8. Elderly travellers should be encouraged to follow standard guidelines for the prevention and management of travellers' diarrhea[78].	CIII

Recommendations	Evidence Based Medicine (EBM) Rating[104]
Managing malaria risk in elderly travellers:	
1. Elderly travellers should use optimal chemoprophylaxis and personal protective measures to prevent arthropod exposures.	AI
2. Chemoprophylaxis decisions should include a careful review of routine and prn medications to identify potential drug interactions with antimalarials.	BIII
3. If using doxycycline for malaria prophylaxis, the importance of taking the medication with adequate amounts of fluid and remaining in an upright position for one hour post dose should be emphasized.	BIII
4. If using atovaquone / proguanil in the elderly, consider checking baseline renal function particularly for those with diabetes, hypertension, and other conditions associated with impaired renal function. Atovaquone/proguanil should not be used if creatinine clearance is < 30 ml/min.	AII
5. Co-adminstration of doxycycline or atovaquone/proguanil with warfarin should be avoided unless adequate monitoring of the INR can be assured.	BII

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